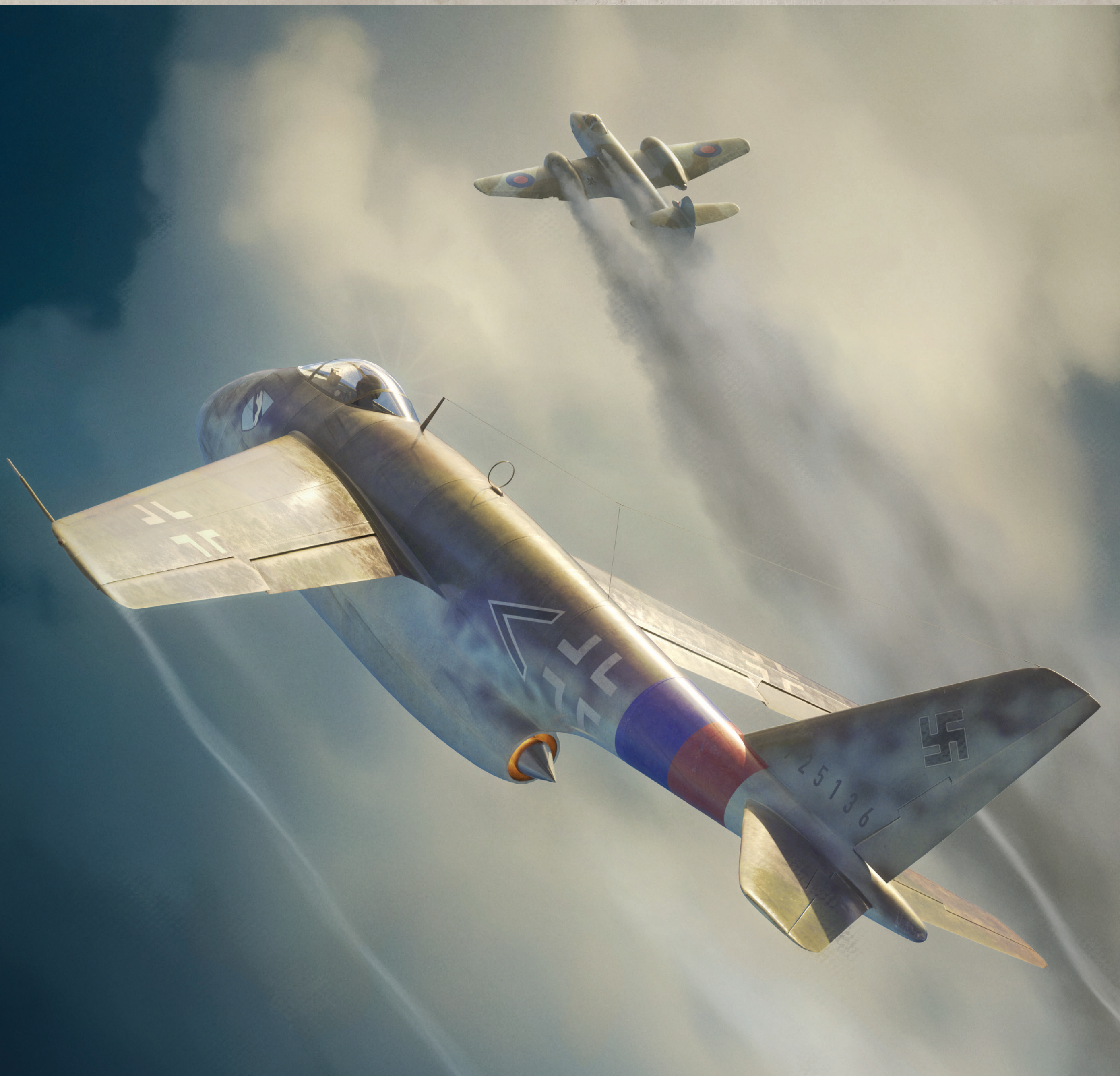
X PLANES

No: 4

Robert Forsyth

LUFTWAFFE EMERGENCY FIGHTERS

BLOHM & VOSS BV P.212, HEINKEL P.1087C, JUNKERS EF 128, MESSERSCHMITT P.1101, FOCKE-WULF Ta 183 AND HENSCHEL Hs P.135



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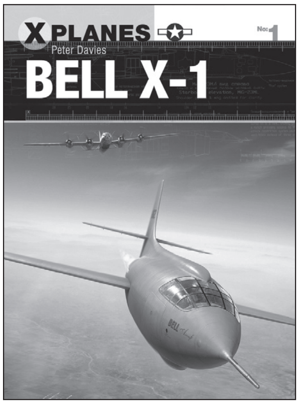
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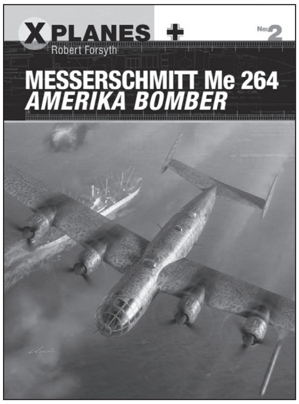
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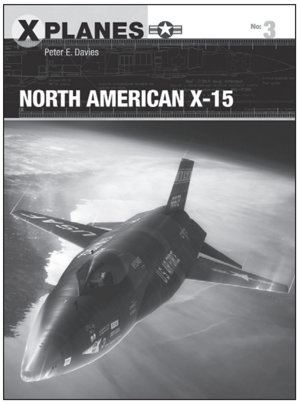
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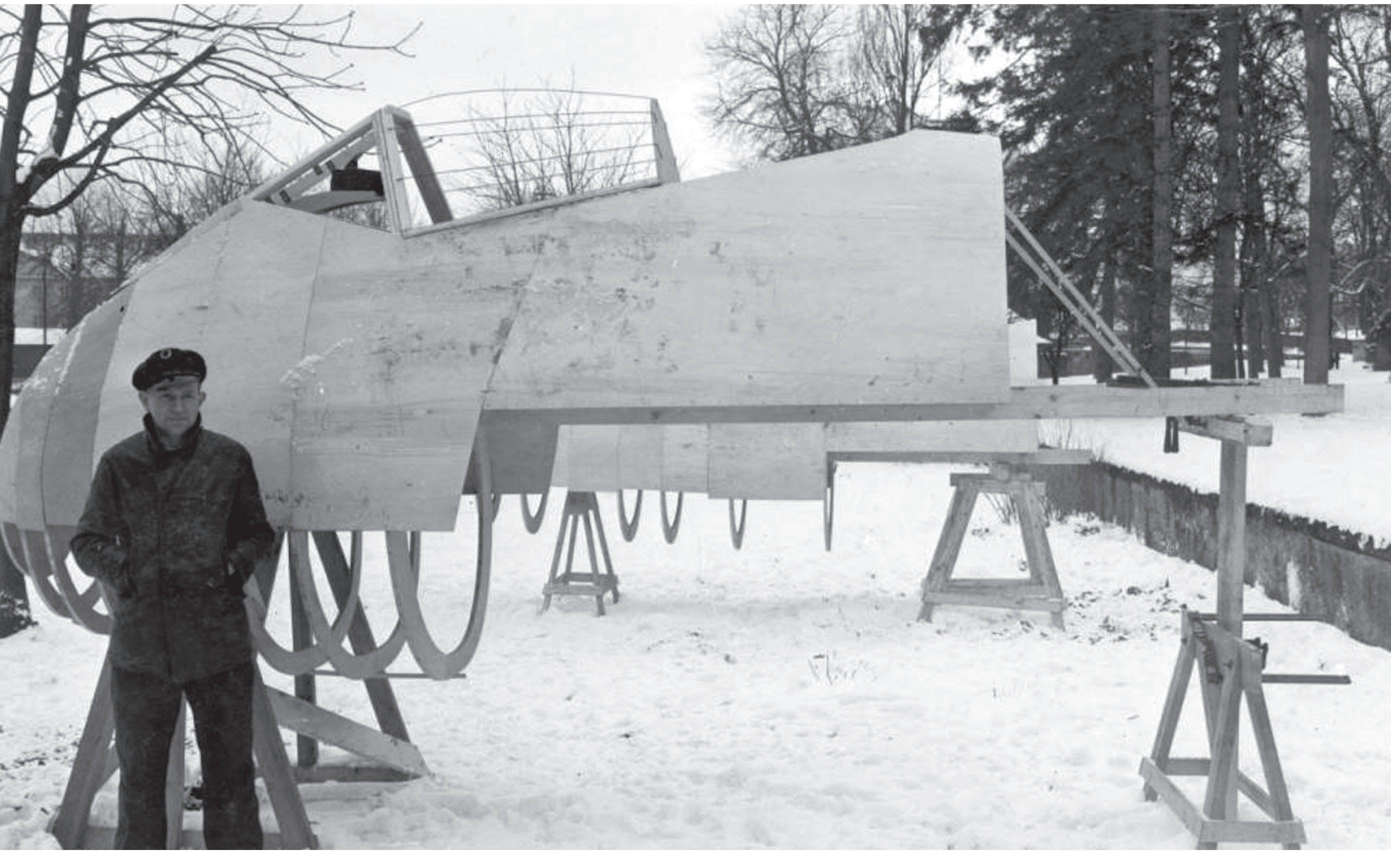

OSPREY
PUBLISHING

This electronic edition published in 2017 by Bloomsbury Publishing Plc

First published in Great Britain in 2017 by Osprey Publishing,
PO Box 883, Oxford, OX1 9PL, UK
1385 Broadway, 5th Floor, New York, NY 10018, USA
E-mail: info@ospreypublishing.com

Osprey Publishing, part of Bloomsbury Publishing Plc

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A CIP catalogue record for this book is available from the British Library.

Print ISBN: 978 1 4728 1994 9
PDF e-book ISBN: 978 1 4728 1995 6
ePub e-book ISBN: 978 1 4728 1996 3

Edited by Tony Holmes
Cover Artwork and Battlescene by Wiek Luijken
Aircraft Profiles and Cutaways by Jim Laurier
Index by Mark Swift
Originated by PDQ Media, Bungay, UK

Osprey Publishing supports the Woodland Trust, the UK's leading woodland conservation charity. Between 2014 and 2018 our donations are being spent on their Centenary Woods project in the UK.

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Acknowledgements
I would like to express my thanks especially to Ted Oliver and Eddie J. Creek for their help and contributions during the writing of this book. I must also extend warm thanks to Huib Ottens, Dan Johnson and Hanns von Rolbeck through whose kind assistance the book includes a rare photograph of a partially completed Ta 183 mock-up airframe.
Additionally, Steve Coates, Tony Holmes, Martin Pegg, Stephen Ransom, J. Richard Smith, Walter Elkins, Arthur Hansen, Keith Hansen and *The Aviation Historian* archive all gave their assistance, for which I extend my gratitude.

Front Cover
In a now regular form of encounter, a Messerschmitt Me 1101 jet fighter of the *Gruppenstab* of I./JG 7 engages a Meteor F 3 of No 616 Sqn over Brandenburg during the defence of Berlin in the early autumn of 1946. The Messerschmitt, based at Brandenburg-Briest, is finished in a typical uppersurface splinter pattern and mottled fuselage sides. It carries the running fox *Geschwader* emblem of JG 7, a single black chevron outlined in white forward of the Balkenkreuz, indicating that it is assigned to a *Gruppe* Adjutant, and a blue and red Reich air defence fuselage identification band. The Werknummer has been applied by stencil in black beneath a black Hakenkreuz outlined in white, which would appear to have been partially oversprayed. JG 7 took delivery of its first new Me 1101s in the summer of 1946, having gradually replaced its Me 262s (Artwork by Wiek Luijken)

Title Page
A rare photograph of a wooden mock-up of the Ta 183 forward fuselage section, possibly taken at Bad Eilsen in the winter of 1944/45. With the civilian worker standing next to it to lend a sense of scale, this section would have housed the cockpit, engine intake, armament and nosewheel. Note how the cockpit would have offered all-round visibility. The mock-up section partially visible on the trestles behind may well have formed the rear section of the intended aircraft. (Hanns von Rolbeck)

X PLANES

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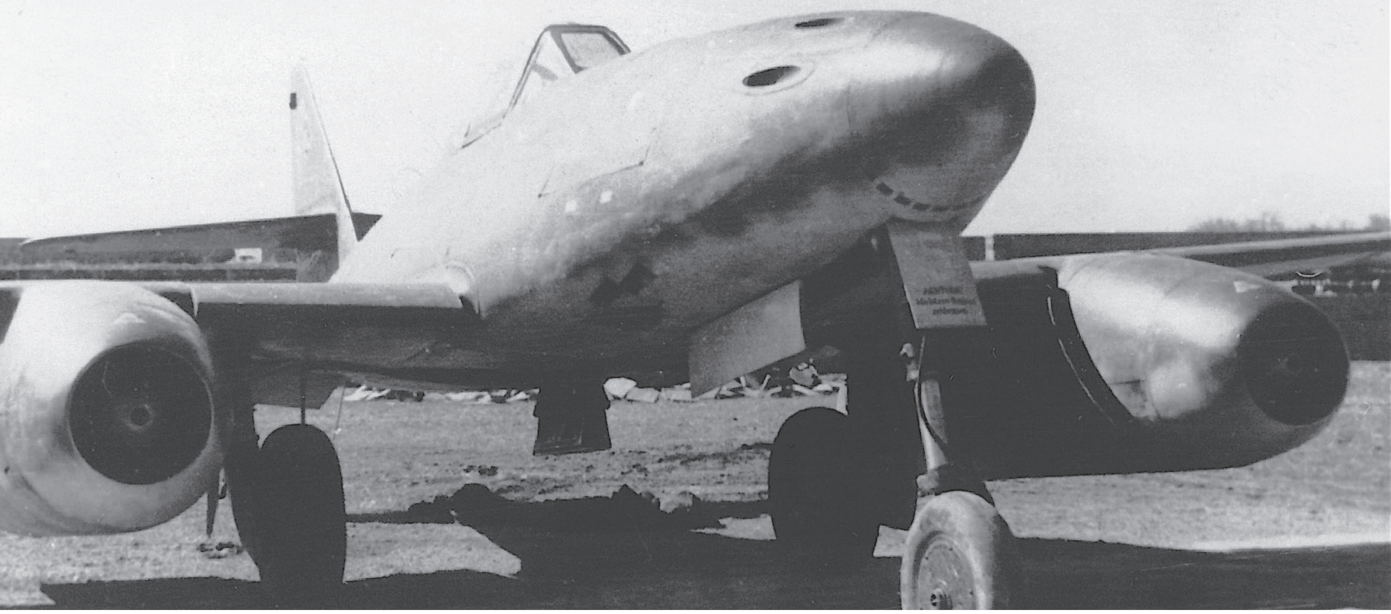


CHAPTER ONE

THE LUFTWAFFE AT WAR

The Messerschmitt Me 262A-1 jet interceptor was the most advanced operational aircraft in the world when it first appeared in Luftwaffe service in late 1944. Powered by Jumo 004 engines, capable of a maximum speed of 900km/h and incorporating swept-back wings, the Me 262 heralded a new era in aircraft design. This example is Wk-Nr. 111745, which served with Generalleutnant Adolf Galland's *Jagdverband* 44 based at Munich-Riem in April 1945. It was flown operationally by several pilots of JV 44 as 'White 5'.

As the sixth year of war in Europe drew to a close, a great Allied vice gripped what remained of Nazi Germany and the territories still under its occupation. Despite a series of massive reversals on the battle fronts and dwindling economic, industrial and military resources, the Third Reich continued to fight a vast two-dimensional European war on land and in the air.

From the east, the Red Army had pushed towards East Prussia and into Hungary, so that by the end of December 1944 the Eastern Front stretched from the Baltic coast in East Prussia, across Poland, Slovakia and Hungary to the Dalmatian coast. In the north, a gap had opened up between German forces, which saw Army Group North fighting in isolation with 27 divisions in Kurland. Facing critical shortages in supplies, especially in fuel, the Wehrmacht had resorted to pressing thousands of horse-drawn vehicles into service. The formations that had once been at the forefront of the great *Blitzkrieg* offensives of a few years before were now reduced to the levels of mobility achieved by the armies of World War I. Yet the fighting had been intense and bitter. Indeed, it was in the East that Germany suffered the bulk of its casualties; of the total of just under 1.5 million soldiers killed, missing or captured between June and November 1944, two-thirds of the losses had been inflicted by the seemingly unstoppable Red Army. Following their relentless advances through Belorussia and the Balkans, the Soviet commanders were preparing to mount a major new offensive aimed at eliminating the German armies defending the Vistula.

The fighting in the air had also been relentless. The severe losses suffered by the Luftwaffe had seen its strength drop from 2,085 aircraft in June 1944 to 1,875 by 1 January 1945. As a measure of the intensity of air operations, the fighters of *Jagdgeschwader* (JG) 54 alone, flying over the Baltic countries and the Kurland sector, claimed no fewer than 600 victories between September and November 1944 (the Soviets reported the loss of 779 aircraft).

But it was in the West that the air war had taken on an even greater scale, for here the Luftwaffe was being bled dry in a campaign of attrition against the overwhelming strength of the Allied air forces in their round-the-clock strategic air offensive against the Reich. Since the summer of 1943, Germany's cities, factories, transport system and communications network had been systematically attacked by formations of four-engined bombers, initially the USAAF's B-17 Flying Fortresses and B-24 Liberators by day, but more recently Lancasters and Halifaxes of RAF Bomber Command had also begun to operate in daylight. In September 1944, the *Oberkommando der Luftwaffe* (OKL) Operations Staff believed that the Luftwaffe fighter force's primary mission was 'the domination of the air over friendly territory and the destruction of enemy aircraft by day and night'. In reality, however, before 'domination' could be achieved, a more immediate goal was 'equality', and even on that count, the Jagdwaffe was substantially outgunned by Allied air strength.

By late 1944, the challenges facing the German air defence system were considerable. Supply of fuel was unreliable, as were the means of its supply; aircraft production was difficult to sustain because of regular Allied bombing attacks; the Allies had much greater supplies of well-trained pilots; their aircraft were powered by more reliable piston engines, giving them a technical advantage; and, finally, they were far ahead in the development of radio and air radar systems. At the end of November, actual Luftwaffe fighter strength on what was termed the 'Western Front' totalled 494 aircraft, of which just 249 were classified as operationally ready. The first half of December had seen 136 pilots lost in home defence operations, but in the week of 23–31 December, German fighter losses on the Western Front were 316 pilots killed or missing. Operations were fast becoming unsustainable.

The last great German ground offensive in the West began on 16 December 1944. It was a plan so audacious that no senior Allied commander expected it. Codenamed *Wacht am Rhein* (*The Watch/Guard on the Rhine* – the title of a German patriotic anthem), the offensive was devised by Adolf Hitler, who wanted to drive an armoured wedge between the Allies by thrusting through the forests and hill country of the Belgian Ardennes to retake Antwerp. He also hoped that he could trap two US armies around Aachen, thus eliminating the threat they posed to the Ruhr. As SS-Oberstgruppenführer Josef 'Sepp' Dietrich's 6. *Panzerarmee* drove west, encircling Bastogne and trapping several thousand American troops, initially the Allied air forces remained largely grounded by bad weather, and operations by the Jagdwaffe during the offensive increasingly took on a ground-support role.

Finally, however, on 23 December, the fog lifted and Allied air superiority was quickly re-established. The rail system upon which the German commanders were so dependent for their supplies was subjected to attack by bombers from the RAF and the USAAF's Eighth Air Force. Hardly a train got through from Germany without being attacked, and Dietrich's tanks were slowly starved of fuel. Simultaneously, USAAF fighter-bombers began a systematic ground-attack campaign in support of the recovering Allied ground forces. Harassed by Allied air power, traversing difficult terrain in adverse weather, short of fuel and meeting firm opposition, the German assault, having penetrated 112km at its deepest point but still far short of Antwerp, faltered and stopped. By 30 December the last attempt to close the Bastogne corridor had failed. With the initiative now lost, the German armies abandoned any hope of further offensive action.

Meanwhile, Generalmajor Dietrich Peltz, the commander of the Luftwaffe's II. *Jagdkorps*, supported by an increasingly despondent Reichsmarschall Hermann Göring, had decided that the best way in which to offer support to the armoured thrust in the Ardennes was to neutralise Allied tactical air power where it was at its most vulnerable – on the ground, on airfields – in a large-scale, ground-attack operation. By using the element of surprise, Peltz had concluded that, as an alternative to the costly dogfights against numerically superior and skilled enemy fighter pilots over the front, such an attack would incur minimum casualties and consume less fuel. Originally intended to coincide with the launch of the ground offensive, the weather frustrated the plan and the operation, known as *Bodenplatte* (*Baseplate*), was deferred despite the commencement of *Wacht am Rhein*.

At the first suitable break in the weather – dawn on 1 January 1945 – German fighters from 33 *Gruppen* left their forward bases and made course in tight formation towards the Allied lines. Complete surprise was achieved and moderate success gained at some enemy airfields, such as at Eindhoven, where two Canadian Typhoon squadrons were virtually destroyed. On others the attacks were nothing short of catastrophic. JG 1 lost 25 pilots for the destruction of 60-plus aircraft, and 29 of its 70 attacking fighters were damaged. Over the Malmedy–Aachen battle zone, the combined force of JG 2 and SG 4 lost 43 machines to anti-aircraft fire. As such, JG 2 had lost half its aircraft. In many cases, however, the German formations failed even to find their allocated targets, whilst elsewhere they fell as victims of their own flak or became lost or collided. *Bodenplatte* was, without doubt, an unexpected and painful blow for the Allies, but the effect on long-term Allied tactical operations would be negligible. For the increasingly beleaguered Jagdwaffe, however, the cost was much higher. In total, 143 pilots were killed or reported missing, including three highly experienced *Geschwaderkommodore*, five *Gruppenkommandeure* and 14 *Staffelkapitäne*, with a further 21 pilots wounded and 70 taken prisoner.

But if *Bodenplatte* signalled, effectively, the end of any meaningful operations on the part of the Luftwaffe's piston-engined fighter force, paradoxically there were new hopes.

Since the late 1930s, German aircraft designers and aeronautical engineers had been at work developing a new technology in the form of the turbojet engine. It had been the Heinkel company that had first got an aircraft powered by a jet engine into the air when the He 178 V1 made its maiden flight on 27 August 1939, powered by a 500kg-thrust HeS 3b engine designed by Hans-Joachim Pabst von Ohain. In February 1940, Ernst Heinkel's contemporary, Professor Willy Messerschmitt, had enhanced the design of his P.1065 of autumn 1938, which in turn led to an RLM specification dating from January 1939 calling for a high-speed interceptor capable of a maximum speed of 900km/h to be powered by a single, unspecified jet engine. Initially, the P.1065 featured a wing virtually identical in planform to that of the early Messerschmitt Bf 109 fighter and was to be powered by two BMW P.3304 turbojets that had been developed by Bramo and which were to be mounted centrally in the wings. Unfortunately, however, the planned engine, designated 109-002, was abandoned in 1942 after some major components had been built and tested statically.

In February 1940 the P.1065 had been modified to have its outer wing sections swept back 18 degrees 32 minutes in order to solve problems that the eventually larger engine diameters and heavier weight estimates for the P.3304 and P.3302 (109-003) had caused in respect to the positioning of the aircraft's centre of gravity.

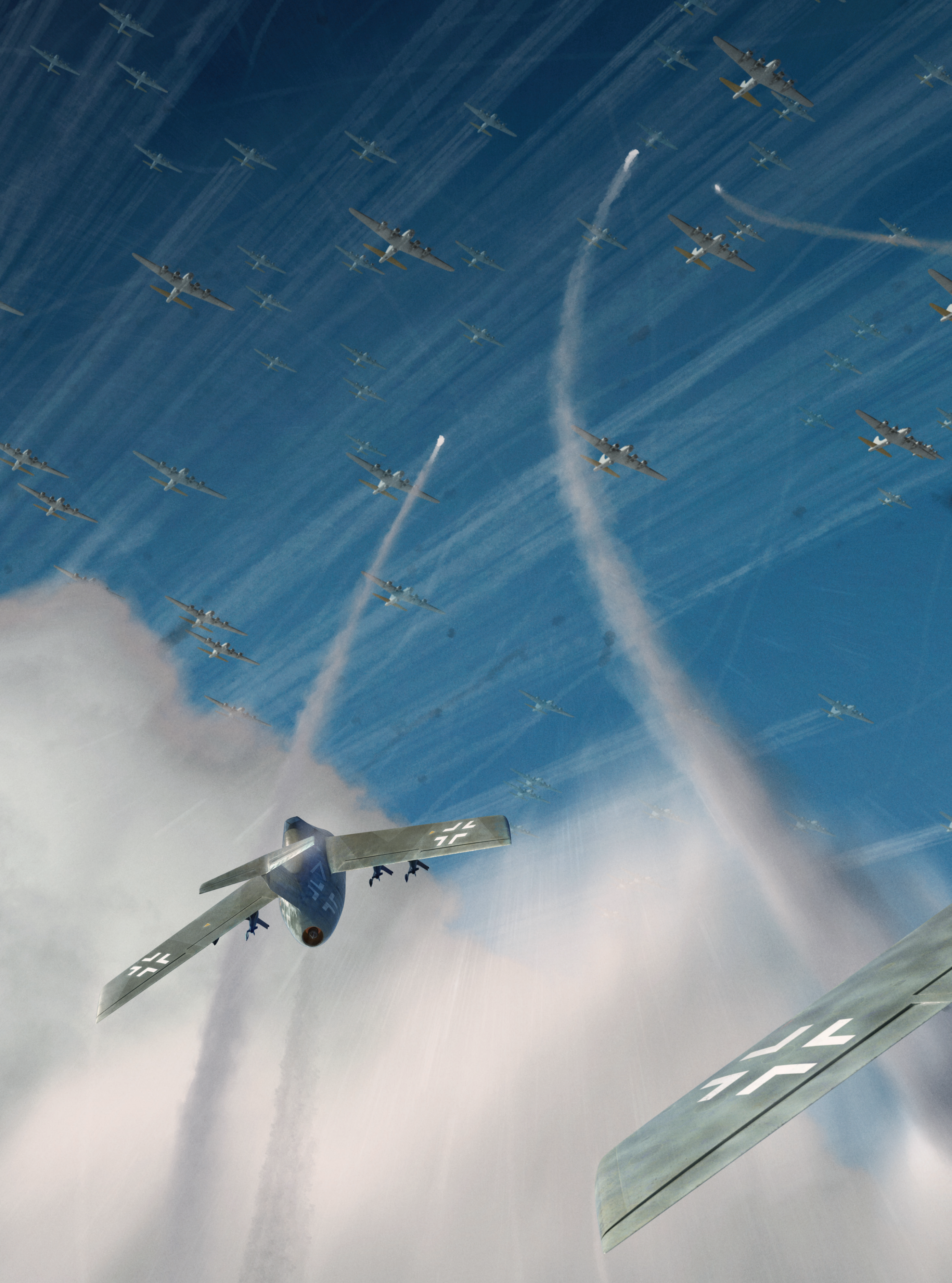
In order to get the prototype P.1065 flying as soon as possible, it was proposed to fit it with a single 700hp Junkers Jumo 210G piston engine in the nose, using a similar installation to that of the Bf 109D. As soon as they became available, two BMW P.3302 engines were to be mounted under the wings.

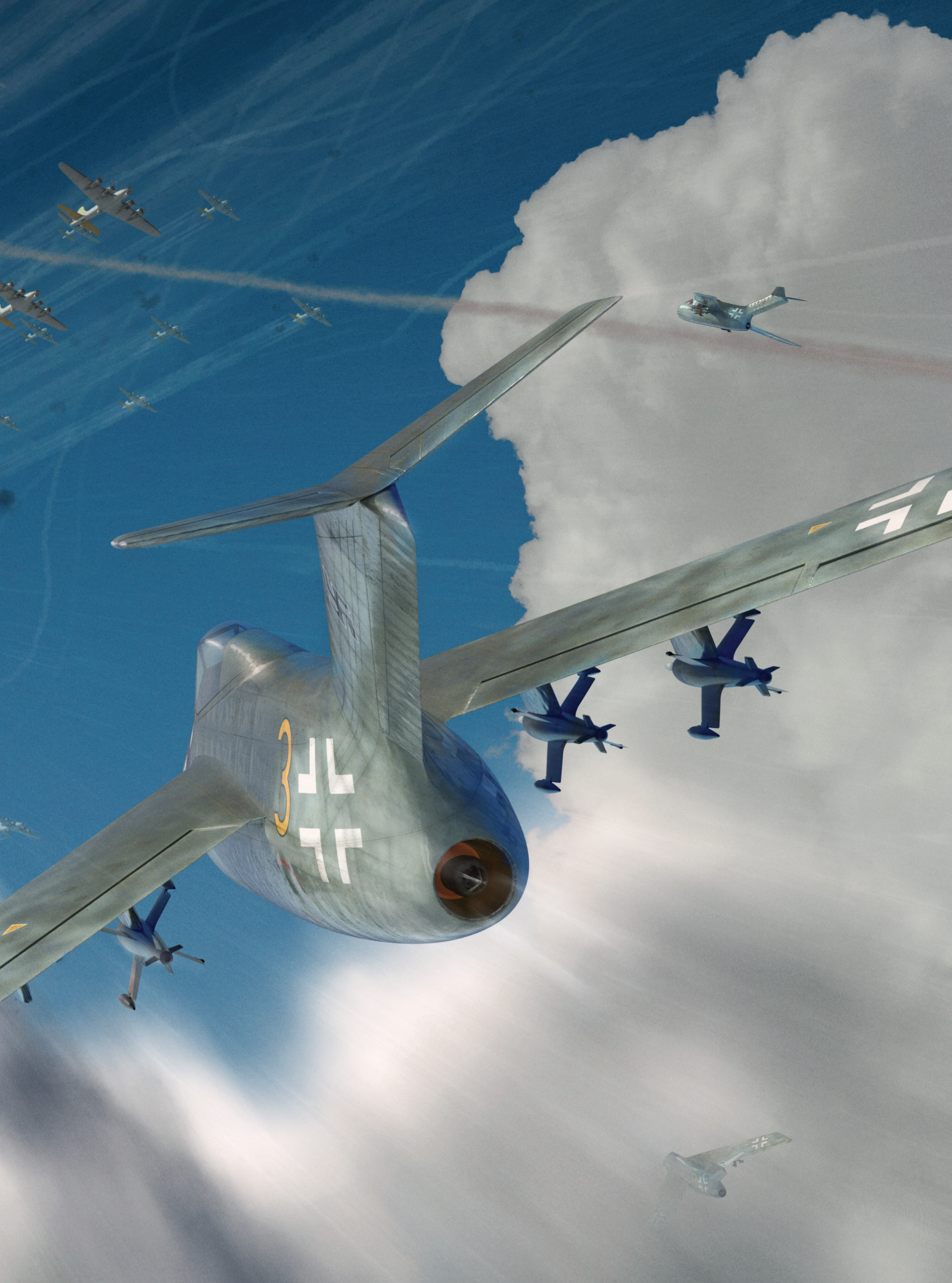
After wind tunnel-testing had shown that sweeping the wing back 18 degrees improved the aircraft's limiting Mach number, a proposal was issued on 4 April 1941 to develop a 35-degree swept-back wing under the designation Pfeilflügel ('arrow' or swept wing) I. This was to have an area of 20sq m and a span of 10m. Construction of the first P.1065 prototype took place between February and March 1941, the project receiving the official RLM (*Reichsluftfahrtministerium* – Reich Air Ministry) designation 'Me 262' on 8 April. A few days previously, on 30 March, Heinkel's new jet fighter, the He 280, had made its first flight powered by two 720kg-thrust HeS 8A turbojets. An initial flight of the Me 262 V1 powered by two early BMW P.3302 turbojets

NEXT PAGES

DEFENCE OF THE REICH

Two Rotten of Focke-Wulf Ta 183 jet fighters of I./JG 1 based at Parchim, in northern Germany, close in on a formation of B-17s from the Eighth Air Forces's 487th BG heading for transport targets in the Magdeburg area in the late summer of 1946. The jets are armed with Ruhrstahl X4 missiles mounted on underwing racks in addition to their MK 108 cannon. I./JG 1 was the first Luftwaffe unit to convert to the Ta 183, the Focke-Wulf replacing the *Gruppe*'s He 162s in early 1946.





on 25 March 1942 had to be prematurely terminated when the port engine malfunctioned at an altitude of 1,000m.

The Me 262 finally took to the air for its first purely jet-powered flight on 18 July 1942, when company test pilot Fritz Wendel made a trouble-free flight in the third prototype, the V3, from Leipheim. BMW was still grappling with design issues, so the aircraft had been fitted with less complex Jumo 004A engines, and Wendel was able to report generally smooth handling during the test-flight in which he achieved an unprecedented airspeed of 720km/h. Despite misgivings, Wendel also recorded that the engines 'worked well'. Germany now possessed the technology it needed to respond to the ever-growing threat of Allied air power in the West.

From then on, until mid-1944, development on the Me 262 forged ahead using a series of prototypes to test all aspects of the aircraft. Low points were encountered when some of the early prototypes crashed and two test pilots were killed. Nevertheless, the new jet interceptor had been championed by a small number of leading Luftwaffe fighter aces. On 17 April 1943, Hauptmann Wolfgang Späte, a 72-victory Knights Cross-holder, became the first Luftwaffe pilot to fly the Me 262 when he took the V2 aloft. Two days later he reported to the *General der Jagdflieger*, Generalmajor Adolf Galland, 'The climbing speed of the Me 262 surpasses that of the Bf 109G by 5 to 6m/sec at a much better speed. The superior horizontal and climbing speeds will enable the aircraft to operate successfully against numerically superior enemy fighters. The extremely heavy armament (six 30mm guns) permits attacks on bombers at high approach speeds with destructive results despite the short time the aircraft is in the firing position…'

Galland was greatly enthused by the aircraft when he flew the Me 262 V4 himself and made his famous report to Göring, in which he proclaimed, 'It felt as if angels were pushing!' Galland became a firm advocate for the further development of the jet and wrote to his superiors that all measures should be taken to ensure swift and large-scale production of the aircraft. In a report to *Generalluftzeugmeister* Erhard Milch he wrote, 'The aircraft represents a great step forward and could be our greatest chance; it could guarantee us an unimaginable lead over the enemy if he adheres to the piston engine.'

The Me 262 eventually emerged as a twin-engined jet fighter powered by two Jumo 004B turbojet units that had an eight-stage axial compressor and single-stage turbines producing 900kg of thrust at 8,700rpm. In the standard A-1a fighter/interceptor configuration, it was to be armed with four formidable 30mm MK 108 cannon mounted in the nose. By September 1944, some 30 Me 262A-1s had been delivered to *Kommando Nowotny*, a dedicated trials and assessment unit set up by Galland and placed under the command of the acclaimed Eastern Front fighter ace Hauptmann Walter Nowotny. The following month saw the first tentative operations, but in the first half of October no fewer than ten jets were either destroyed or damaged due to takeoff or landing accidents. Nowotny's pilots, most of them drawn from conventional single-engined fighter units, lacking sufficient training in instrument flying and with only two or three intended training flights, found the Me 262 with its effortless speed, short endurance and rapid descent difficult to handle.

Despite a damning indictment on the unit's capabilities by Fritz Wendel and Hitler's persistent demands since November 1943 that the Me 262 should fly as a high-speed bomber rather than as an interceptor, *Kommando Nowotny* struggled on into November 1944. But on the 8th disaster struck when Nowotny crashed to his death in an Me 262, having been intercepted by USAAF fighters on his way back from a mission. Four days after Nowotny's death, in the wake of Hitler's semi-reluctant agreement that the jet should be built as a fighter rather than as a bomber, it was decreed that a newly formed *Jagdgeschwader*, JG 7, was to be equipped with the Me 262 and not, as originally planned, with Bf 109G-14s. By the end of November the *Geschwader*, under the command of Oberst Johannes Steinhoff and now known by the new honour title of *Jagdgeschwader* 7 '*Nowotny*', had only 11 of the 40 aircraft it was allocated. Even as more machines trickled in during December, a number were lost to bomb damage and training crashes, while numerous others suffered damage from various causes, either accidental or as a result of enemy raids. At least four precious pilots were lost during December to accidents.

Nevertheless, most pilots recognised that, as with all aircraft, there were good and bad points with Me 262. Major Rudolf Sinner, the *Kommandeur* of III./JG 7, gave a balanced appraisal of the jet interceptor:

'I was pleased and proud to be made responsible for the testing and operation in combat of a new, greatly promising and interesting weapon. With the advantages of increased speed and firepower it was now possible to catch aerial targets – especially photo-reconnaissance aircraft – which, due to their superior performance compared to our piston-engined fighters, could previously not have been taken on. Furthermore, we could attack heavily defended and escorted bomber formations with a considerable chance of success and less risk than was the case with piston fighters. Alongside this, with repeated individual attacks by smaller numbers of combat-experienced pilots in Me 262s, we could seriously harass and confuse strong groups of enemy escort fighters and divert them from their planned defence of the bombers.

'However, there were a number of disadvantages. Flight duration was shorter and more dependent on altitude than a piston fighter. It was defenceless during takeoff and landing. The powerplants were more likely to suffer disturbance and had a shorter life than piston engines. Also, the demands upon airfield size, ground support, engineering, flight safety and tactical management were greater and not adequately attended to. Power dives in the Me 262, in contrast to other fighters, were only possible within a limited range. A sudden, dangerous pitch-up, with heavy control forces, was experienced if the highest permissible speed was exceeded and the starting procedure was more complicated and time-consuming than with piston fighters.

In summary, due to its advantages, the Me 262 was, despite these disadvantages, essentially better-suited to the defence of the Reich than our piston-engined fighters of the time.'

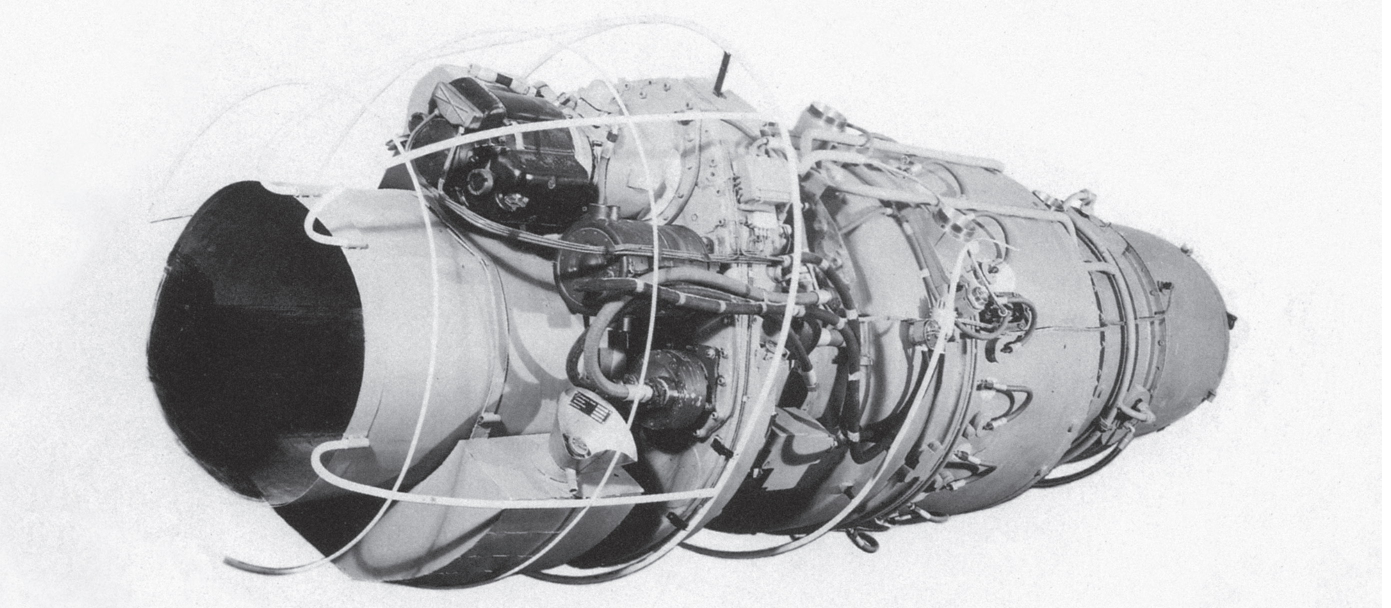
Another JG 7 pilot, Hermann Buchner, explained to this author:

'The Me 262 reached us too late, though it was years ahead of its time from the point of view of its technology. Of course, there were shortcomings, but with more time and sufficient operational experience, these could have been eliminated. The main problem was that the crews had to work out new methods of attack and had to learn how to manage at such high speed. In an attack, firing time was reduced, as we reached the target ridiculously fast. I accounted for most of my claims by basically approaching from the rear.

'Of course, you had to fly through the escort. This was somewhat more difficult with the Fw 190, but was no problem with the Me 262. With a sufficient number of Me 262s deployed, the escort fighters had no chance of preventing an Me 262 from making its attack.'

Indeed, there was no doubt that despite its sporadic deployment in limited numbers, the appearance of the Me 262 in the skies over Germany from the end of 1944 had given the Allies a shock. The Luftwaffe could count on an aircraft which benefited from a technological edge that could not, as yet, be matched. The problem for the Luftwaffe, however, was numbers. By February 1945 Allied fighters virtually ruled the skies over Germany. JG 7 would need every single pilot and every precious aircraft it could acquire, for the coming weeks would test the unit's mettle to its limit.

But remarkably, despite the realities JG 7 faced, in the corridors of the RLM in Berlin influential figures were already turning to the next generation of advanced fighters and jet engines in the increasingly desperate hope that they could yet turn the tide of the war back in Germany's favour – and the aircraft manufacturers were more than willing to comply.



CHAPTER TWO

POWER AND FORM

A mock-up of the Heinkel-Hirth HeS 011A-0 jet engine. The A-0 was a pre-production unit and was capable of achieving 1,300kg-thrust when static, 1,040kg at 900km/h at sea level and 500kg at the same speed at 10,000m. Despite not being completely developed by the time it entered production, the HeS 011 was regarded as the most powerful and most promising engine in Germany by the time the war ended.

On 9 April 1941, Ernst Heinkel's burgeoning aircraft business expanded its interests with the acquisition of Hirth Motoren GmbH, an aircraft engine manufacturing company based in Stuttgart-Zuffenhausen, which also had a branch in Berlin-Grünau. The company had been founded in 1920 by Hellmuth Hirth, a flamboyant, internationally travelled pilot and engineer who was killed in an aircraft crash in 1938. In the wake of Hirth's death, the RLM became the trustee of the company, effectively nationalising it, and subsequently selling it to Heinkel, who had known Hellmuth Hirth and his industrialist father well before the war. The RLM felt Heinkel could best integrate and manage Hirth's engine operations. According to Ernst Heinkel, 'Six other firms were at this time trying to buy the Hirth works, but the scales were weighted in my favour.'

Indeed, four days before Heinkel acquired Hirth, on 5 April 1941, his revolutionary He 280 jet conducted a demonstration flight before a high-level delegation from the RLM including the *Generalluftzeugmeister*, Ernst Udet. Heinkel recollects Udet as being impressed by the performance of the He 280, although he acknowledged that there had been 'much opposition [to] the sale to me of the Hirth engine works behind the scenes. But the demonstration flight of the He 280 had been really decisive. Four days later, I owned the four million mark Hirth engine factory, for which I had to pay six million, a fifty per cent rise. After the optimism of 1939 Udet must have come to the realisation of how hopeless it was to keep up the strength of the Luftwaffe, even for a short time, without some quick and revolutionary development.'

This 'revolutionary development' meant the jet engine. Heinkel's acquisition of the Hirth works on Marconi Strasse on the northern edge of the town enabled it to enlarge its jet engine design team and production capability. Zuffenhausen was equipped with overhead gantry and trolley test beds, enabling the efficient and easy moving of a suspended engine. Heinkel recalled, 'Zuffenhausen was a development factory for sports machine engines and had to be enlarged and partly reconstructed before my work could really start. It was particularly suited to my needs because it had produced exhaust-gas turbines under license and possessed a great many assembly specialists who would be useful for jet work.'

By late 1942 Heinkel's outstanding engine specialist, the physicist and designer Hans von Ohain, had moved from Heinkel's plant at Rostock to Zuffenhausen, where he and his team of some 150 engineers, designers and research workers were briefed to focus on the design and development of a new Class II turbojet engine. Rated with a static thrust of up to 2,000kg, it would eventually materialise as the HeS 011 ('HeS' denoting *Heinkel Strahltriebwerk* – 'jet engine'). This was, effectively, the result of a progressive development in flow path from the earlier HeS 3b and running through the subsequent HeS 8 and HeS 9 engines.

The actual design for the HeS 011 (RLM designation 109-011) was the outcome of a specification for a bomber aircraft issued by the RLM in July 1941 that called for a turbo-prop powerplant consisting of two compressor turbine sets, two combustion chambers and a power turbine driving a variable pitch propeller. Heinkel-Hirth adopted the view that prior to construction of such an engine, it would first be necessary to build a turbo-jet unit which, in effect, would form half of the powerplant. Initial design work on the HeS 011 was completed by September 1942, and five prototypes were planned. Based on experience gained from the HeS 8A, this very compact engine had been intended to produce 1,300kg thrust. It had an unusual compressor/turbine consisting of an axial flow inducer followed by a diagonal flow impellor, three axial stages and a two-stage axial flow turbine – all known as a *Kombinationsgebläses*. The annular combustion chamber was followed by a two-stage turbine with hollow, air-cooled blades. Like the Jumo 004 jet engine, the HeS 011 had an adjustable jet nozzle controlled by a 'bullet'. This had two positions – one for idling, the other for all other running conditions. Two alternative Riedel starter motors were proposed, one of 10hp and the other of 20hp, the larger unit necessitating the introduction of a longer cowling.

Problems soon arose, the diagonal compressor on the first prototype, the V1, failing after only one hour on the test bench. The Heinkel company grappled with this and other difficulties over a period of several months, and specialists from the engineering firm of Hans Voith at Heidenheim were brought in to assist with the milling out of a solid 'cheese' of aluminium alloy.

By the early spring of 1943, there were also tensions at Zuffenhausen. Von Ohain remained as Chief Engineer in charge of design and construction, but Dr Harald Wolff, who had previously worked for BMW, was brought in as technical controller of turbojet development. Udet's successor, Generalfeldmarschall Erhard Milch, then relieved Heinkel of control of the Hirth plant on 2 March. For his part, Heinkel was of the opinion that Wolff was not making sufficient progress. At this assertion, Wolff complained to Milch, who promptly appointed Wolff head of the entire Heinkel-Hirth works. On 25 March, Milch wrote to Heinkel about the HeS 011:

'In order to complete the project within the shortest possible time, it is indispensable that there should be absolutely clear-cut directional control, and that this should be placed entirely in the hands of someone experienced in this field.

'In order to achieve this aim and to take the burden off your shoulders, I have decided to entrust the whole of the Zuffenhausen factory to Dr Wolff with immediate effect. He is taking over this task and assuming full responsibility towards the Technical Department. His management will continue until the delivery of the first 100 mass-produced HeS 011s. When this goal has been reached, I will inform you of my decisions.'

Finally, by the end of 1943 or early 1944, the first five prototype engines had been completed. Then, in early 1944, work commenced on a second series of HeS 011 prototypes suitable for flight tests. The major change in this series was the shortening of the engine by the redesign of the combustion system and by supporting the rotor on two, instead of three, bearing sets. The diagonal impellor design was changed to a composite construction, in which the blades were machined from aluminium alloy forgings retained by a bulb root of approximately 2.5cm in diameter in a steel hub. The combustion chamber was also completely redesigned.

However, the threat of Allied bombing meant that the Zuffenhausen works and associated factories in the Stuttgart area had to be dispersed to what were deemed as safer locations, such as a salt mine at Friedrichshall/Kochendorf, 16km north of Heilbronn, where work commenced on the HeS 011 in June 1944. At some stage prior to the end of the war, one engine was air-tested at Stuttgart while attached to a Ju 88. The HeS 011, however, would never fly under its own power.

According to Ernst Heinkel, even those gifted with a deep understanding of gas turbine and jet engine design – such as the German engineer and jet engine specialist Oberstabs-Ingenieur Dipl.-Ing. Helmut Schelp, who worked as the *Referent für Sondertriebwerke* (*Strahltriebwerke*) in the RLM's GL/C-E 3 (jet engine development section) – failed to grasp the reality of the situation. He recalled:

'The optimistic expectations of Schelp that the HeS 011 would be ready in a short time proved as illusory as Wolff's repeated promises. The production of the oblique-flow rotor, which it was well-nigh impossible to make accurately, was at last achieved after enormous efforts and expense thanks to aid given by Voith's firm at Heidenheim. It took years.

About 3,000 working hours alone on the milling-machine were needed to produce one diagonal compressor. Only at the end of 1944 and the beginning of 1945 was the HeS 011 sufficiently advanced to run on the bench and achieve the required 1,300kg thrust. It was now the most powerful unit in Germany, but it came too late.'

Indeed, by January 1945, four of the new prototypes had completed 184 hours running on the test bench, but these tests rarely saw more than 1,000kg of thrust achieved.

Three basic production models were proposed – the HeS 011 A, B and C – a prototype series being planned for each. Following the completion of the first five prototype engines, 20 development prototypes were to be produced for the A model (the HeS 011 V6 to V25), 60 for the B model (V26 to V85) and the designation HeS 011 V86 onwards being allocated for the C model.

Plans had been made for the HeS 011 engine to go into production by the end of 1945 in order to power Germany's second generation of jet aircraft, but its development was very slow due to machining problems associated with the construction of its complicated compressor. Furthermore, by April of that year, Allied bombing attacks on the transport and communications network, as well as the evacuation of the Zuffenhausen factory, meant that further work was all but impossible. Ultimately, by the end of the war, some 40 engines had been completed, including nine HeS 011A-0 pre-production units in which the combustion system had had the major re-design. The enhanced HeS 011B and C designs were intended to produce 1,500kg and 1,700kg of thrust, respectively, but they were never finished.

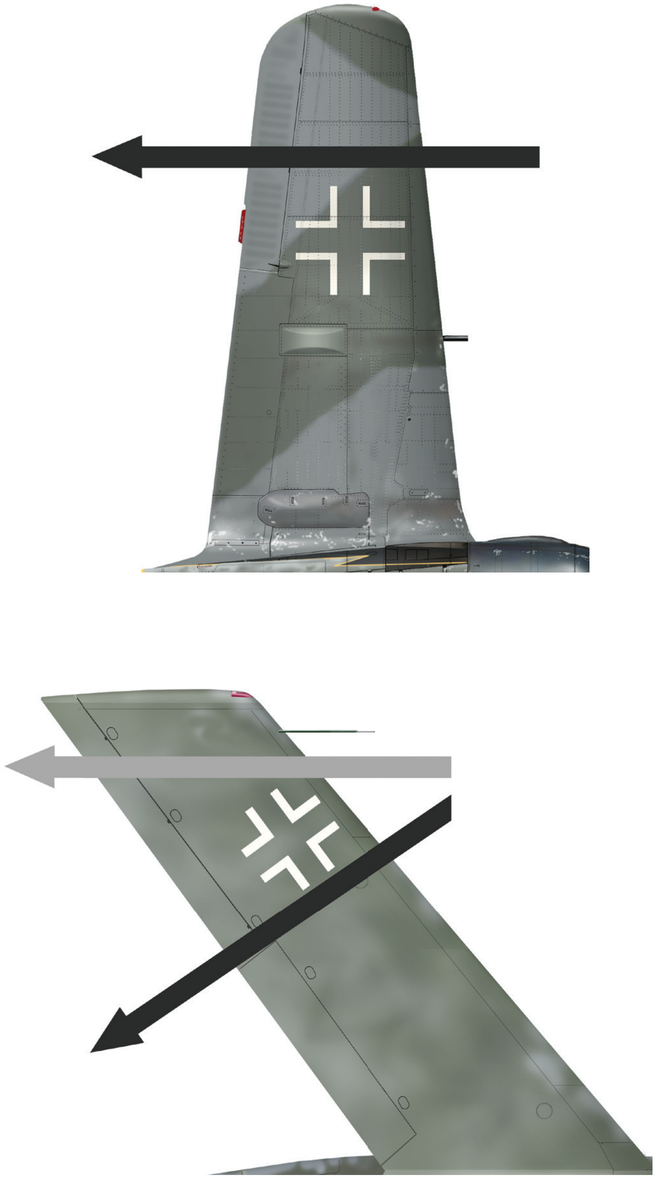
During his interrogation by the Allies after the war, Oberstabs-Ing. Schelp revealed that he considered the HeS 011 as Germany's 'best and most promising' long-term engine project, a view that was shared by personnel from Messerschmitt.

HeS 011 A SPECIFICATION	
Length (with bullet extended and short nose cowling)	3.45m
Length (with bullet extended and long nose cowling)	3.60m
Height (over cowling)	1.08m
Maximum diameter	0.875m
Width (over cowling)	0.85m
Weight (with accessories)	950kg
Starting rpm	3,000
Idling rpm	6,000
Maximum rpm	11,000
Static thrust at 11,000rpm	1,300kg
Static thrust at 10,000rpm	965kg
Static thrust at 9,000rpm	710kg
Static thrust at 8,000rpm	500kg
Thrust at sea level at 0mph	1,300kg
Thrust at sea level at 400km/h	1,065kg
Thrust at sea level at 800km/h	1,015kg

SWEEPING BACK

The conventional aerodynamic characteristics of a wing long depended on airflow moving in a direction perpendicular to the leading edge. But as early as the 1930s, German scientists and aerodynamicists had studied the possibilities offered by swept-back wing design as an aid towards supersonic speed. Indeed, during the 5th Volta Conference in Rome in October/November 1935, Dr-Ing. Adolf Busemann, a lecturer at the *Technische Hochschule* in Dresden, presented his studies into aerodynamic lift at supersonic speeds. But it would be some time before Professor Dr Albert Betz, the Director of the *Aerodynamische Versuchsanstalt* at Göttingen, rekindled interest following his wind tunnel experiments at Göttingen using wings with 45-degree sweepback, the results of which were published in 1939. They showed how a swept-back wing offered a clear benefit at drag coefficients above Mach 0.8. Subsequently, Busemann and Betz applied for a patent on the swept-wing concept.

In the case of a swept wing, the airflow velocity could remain well in the subsonic range at speeds approaching, or even exceeding, the speed of sound, the wing being used to delay the onset of compressibility effects encountered at high subsonic speeds – i.e. it is used to delay the critical Mach number to higher speeds. In effect, turbulence and shock waves could be avoided as an aircraft approached the speed of sound if its wings were swept back. In late September 1940, Professor Hubert Ludwieg presented the results of a series of tests initiated by Messerschmitt at the Göttingen wind tunnel on a range of swept-back models (15–45 degrees), as well as on profiles and forward-swept wings. This gradually prompted a number of German aircraft companies to embark upon designs featuring sweepback. Numerous projects were considered, but the companies' work appears to have been focused on only those aspects essential to the development of their own designs. Systematic forms of research were seldom undertaken by the aircraft industry itself, and it relied on the data contained in the technical and scientific reports



The Swept Wing

The swept wing serves to reduce the element of airspeed perpendicular to the wing leading edge, neutralising the increase in turbulence and drag that occurs at near-supersonic speeds.

distributed by the *Zentrale für wissenschaftliches Berichtswesen* (ZWB), based within the RLM, and the *Deutsche Versuchsanstalt für Luftfahrt* (DVL – German Aviation Research Establishment) at Berlin-Adlershof. In reality, much of the reticence over swept-back wing design on the part of the manufacturers was due to the lagging state of engine development and maximum speeds achievable at the time.

From mid-1943, however, through to early 1945, as this situation improved, numerous jet engine-based project proposals to be powered by the planned HeS 011 were put forward by Arado, Blohm & Voss, Focke-Wulf, Heinkel, Henschel, and Messerschmitt. Indeed, in January 1944 the desire to improve the performance of the Me 262 then undergoing design work received fresh impetus at a meeting held with Professor Messerschmitt on the 5th of the month, during which he proposed building 'a high-speed experimental aircraft to evaluate current knowledge on flight at high Mach numbers'. The aircraft was to be fitted with a 35-degree swept wing and was to be propelled by two jet engines.

In March 1944, Willy Messerschmitt officially put forward a proposal for a modified version of the Me 262, to be known as the Me 262 HG (*Hochgeschwindigkeit* – high-speed), of which there were three potential variants, all incorporating swept-back wings and tails for high performance. In the case of the HG III, the most advanced of the three variants, in a plan dated 24 December 1944, the aircraft was to feature a wing and tailplane swept back by 45 degrees together with a streamlined canopy, while power was to come from either twin BMW 003C, Jumo 004D or HeS 011A engines housed in the wing roots.

On 16 April 1944, the Messerschmitt Project Office at Oberammergau received a visit from Oberstleutnant Siegfried Knemeyer, the Chef Technische Luftrüstung in the *Abteilung Entwicklung* (Chef TLR/E – Head of Air Technical Equipment, Development Department) at the RLM. Knemeyer was keen to know more of Messerschmitt's high-speed development plans. Waldemar Voigt, the head of the Project Office, noted that:

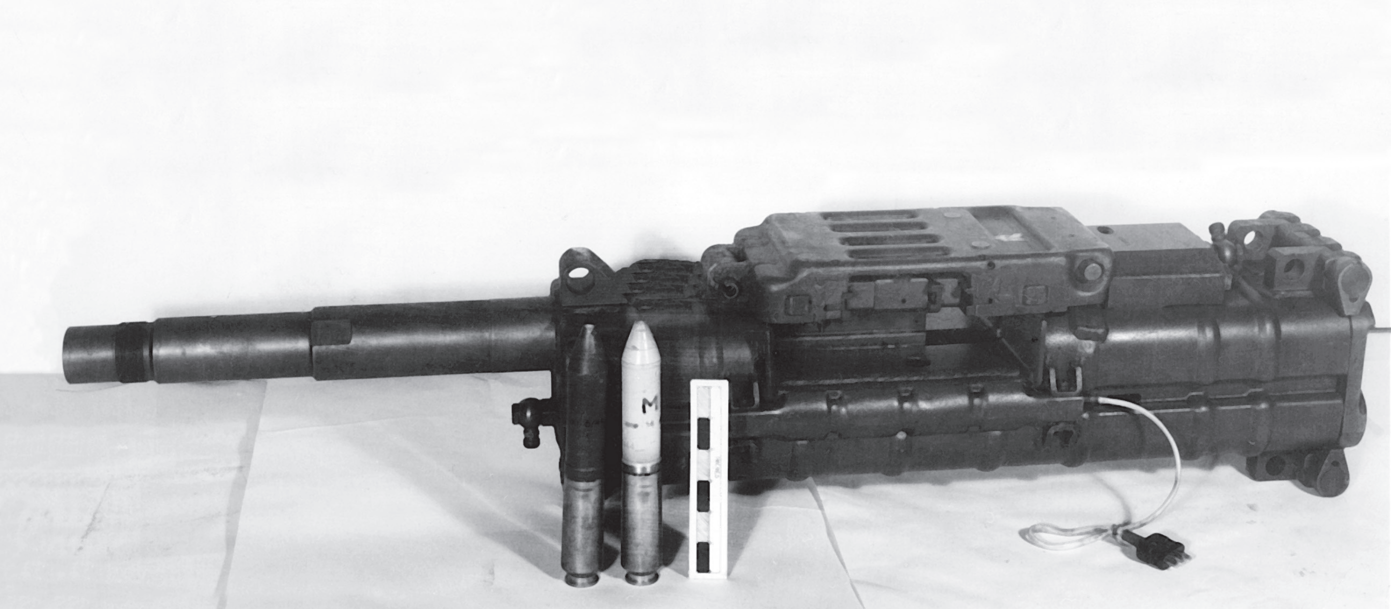
'Oberstleutnant Knemeyer was informed of our intention to develop the Me 262 to reach higher speeds. This work entails penetrating the high Mach number region, for which very little data is available. We therefore intend, by modification and with new components, to produce two different test aircraft with which to verify current knowledge and opinions on methods of improving performance. These aircraft will not be suitable for immediate production. In contrast to our previous work, they will require a considerable increase in the number of project, design and production man-hours.

'Oberstleutnant Knemeyer considers it absolutely vital to pursue this work vigorously and independently of urgent daily tasks. He requested the participation of the DVL in the testing of the aircraft. He also said that the results of the tests should be made available to other companies and that full use should be made of other firms' experience.

'After inspecting the mock-up of the P.1100 [a two-seat bomber derivative of the Me 262], Oberstleutnant Knemeyer commented again on the proposed performance improvements to the Me 262 and emphasised that he saw it as one of the company's most important tasks and that attempts must be made at all costs to maintain or achieve a lead in this direction over other countries.'

The P.1100 incorporated the wing and tail of the Me 262A-2a but with a radically enlarged fuselage and strengthened undercarriage. It was proposed to create fighter, bomber and nightfighter versions, armed with varying numbers of the potent 30mm MK 108 cannon. Again, power would come from either twin Jumo 004C or HeS 011A turbojets that were to be located further back along the wing towards the trailing edge.

By mid-1944 the RLM had become more than aware that, in the air war against the Allies, it would be imperative for Germany to maintain a technical superiority in its fighter aircraft. Men of foresight and technical awareness, like Knemeyer, also recognised that engines such as the pending HeS 011, combined with the creative enhancement of swept-back wing design, could offer the Reich salvation in the months ahead – that is, if the Allies did not get there first.



CHAPTER THREE

THE EMERGENCY FIGHTER PROGRAMME

The principal weapon of the Luftwaffe's Emergency Fighters, the 30mm MK 108 cannon was manufactured by Rheinmetall-Borsig and proved good for close-range fire against heavy bombers. It was a powerful weapon, but its cheapness and ease of manufacture made it prone to jamming and other forms of malfunction. Additionally, its relatively slow rate of fire, though very destructive, made successful combination with the speed of an aircraft as fast as the Me 262 difficult to achieve.

When Heinkel's progress on the HeS 011 engine became more widely known in 1943, German aircraft manufacturers were encouraged by the fact that they would have an engine to replace the less powerful Junkers Jumo 004 and BMW 003 turbojets which were shortly due to go into service. Paradoxically, at a time when Nazi Germany was riven by increasingly biting shortages in skilled labour and vital materials, a number of companies, notably Focke-Wulf and Messerschmitt, began to work on new designs for single-engined jet fighters that would be capable of equalling or bettering the only real, existing contender of the time, the Me 262. The latter was to be powered by the Jumo 004 engine, a 'Class I' turbojet – an engine with thrust rated up to 1,000kg, whereas the HeS 011 was a Class II engine, rated up to 2,000kg.

Although throughout 1943 and 1944 the RLM placed its faith in the Jumo 004-powered Me 262, and therefore issued no revised requirement for new aircraft, the major shortcoming of the Jumo and BMW units was their unreliability at altitudes above 11,000m. Furthermore, the Me 262, which had been designed some years before, was heavy, needed two engines and was costly to produce in terms of materials and man-hours. The metals needed for its construction were also becoming harder to source.

Towards the end of 1944, the RLM realised that an improvement in engine performance would be needed in order to compete in terms of both speed and altitude with the new types of Allied jet aircraft expected to make their debuts over Europe later in 1945. Intelligence had been obtained on the American Bell P-59 Airacomet fighter, which was powered by a pair of the new General Electric I-16/J31-GE-5 turbojets that gave the aircraft a maximum speed of 413mph (665km/h), and also the more potent British Gloster Meteor, deliveries of which had commenced to the RAF in July 1944. This sleek fighter was powered by twin 1,700lb-thrust Rolls-Royce Welland W.2B/23C turbojets, giving a maximum speed of 415mph (668km/h) and was armed with four 20mm Hispano cannon. This was impressive, but both aircraft lagged behind the Me 262, which could achieve 870km/h at 6,000m. The concern, however, was how quickly the Allies could improve their aircraft.

It was hoped that the solution to this problem lay in the HeS 011, which would be able to operate at ceilings greater than enemy aircraft, especially if it incorporated the anticipated duplex fuel injectors that would improve performance at high altitude over simplex or single-nozzle fuel injectors.

It was against this scenario that at the end of 1944 Oberstleutnant Siegfried Knemeyer, the Chef/TLR in the RLM, initiated a tender-style competition amongst all the leading aircraft manufacturers. This called for a new-generation, jet-powered 'emergency' fighter/interceptor that would be capable of taking on Allied jets over Germany as well as being able to deal with the formidable B-29 Superfortress four-engined heavy bomber that it was believed would replace the USAAF's B-17 Flying Fortress during 1945. Since 1942, the B-17, together with the B-24 Liberator, had fought the USAAF's daylight bombing campaign, and with its formidable defensive armament it had proved a tough adversary. But the B-29, which was already in operation in the Far East and which had a greater bomb-load capacity than the B-17, would raise the stakes even higher. As early as November 1944, one aircraft manufacturer, Ernst Heinkel AG, spent some time assessing the best armament to fit into its prospective He 162 *Volksjäger* in readiness for combat with the B-29.

As an example of the alarm caused by the prospect of the Superfortress, at the daily OKL situation conference on 31 March 1945, a Luftwaffe intelligence officer reported that 'in the last attack on Berlin, ten American four-engined B-29s were seen for the first time, flying at an altitude of 9,500m. The appearance of this American high-altitude and long-range bomber in Europe would mean that the present four-engine types are already going out of production and are being replaced only by the B-29.' The reality was that there were no operational B-29s in Europe. Nevertheless, to the Germans, the appearance of Allied jet fighters and B-29s was a clear threat and likelihood.

Knemeyer sent his 'emergency' tender to Junkers at Dessau, Blohm & Voss in Hamburg, Focke-Wulf in Bremen, Messerschmitt in Augsburg and Ernst Heinkel in Wien (the Henschel works at Berlin-Schönefeld would be brought in later). The specification read as follows:

Oberstleutnant Siegfried Knemeyer, the head of Luftwaffe aeronautical technical development in the *Reichsluftministerium* in late 1944. As a skilled military pilot and engineer with a considerable knowledge of aerodynamics and electronics, he was the RLM's immediate choice to oversee the emergency fighter projects.

'The armoured pressurised cockpit is to accommodate one pilot. In an emergency, the pilot must be able to eject from his seat by means of a catapult device. The fire-protected fuel tanks will provide fuel for one hour of full-power flight. For power the HeS 011 jet engine will be provided and for takeoff, additional boost rockets will be required. For armament, four MK 108 automatic machine cannon are required. The aircraft must be fitted with full radio equipment. At full throttle at 7km altitude, an airspeed of around 1,000km/h is required. Furthermore, there should be capability to carry a total load of up to 500kg of bombs of all calibres.'

A highly experienced aviator and technically brilliant, Siegfried Knemeyer was a man ideally suited to assessing the proposed designs. Reichsmarschall Hermann Göring considered him to be his 'stargazer' because he was able to see the future of aircraft development. During the early 1930s, Knemeyer invented the Dreieckrechner (triangle calculator), a handy circular slide rule designed to support a pilot or navigator in making course calculations for long-range flights.

In 1936 Knemeyer was employed by the RLM as a civilian adviser, and then at the outbreak of World War II he joined the Luftwaffe as a pilot with the *Aufklärungsgruppe des Oberbefehlshabers der Luftwaffe* (Reconnaissance Group of the High Command of the Luftwaffe). He subsequently served as a reconnaissance pilot and went on to fly the He 111, Fw 200 and Ar 240 on missions over Norway and England. He was promoted to Hauptmann on 1 May 1942. From the end of June 1942 until 17 July he was based on Crete and flew high-altitude reconnaissance sorties in support of the *Afrika Korps*. In the late summer of 1942 Knemeyer flew in the new Ju 88B from Bulgaria over the Crimea, taking photographs that would be used to create up-to-date operational maps of the area, as well as across the northern coast of Turkey to Baku in Azerbaijan. On 27 August 1943, he was appointed to Göring's personal staff as a radio and navigation officer and, two days later, he was awarded the Knight's Cross. Knemeyer was appointed as Chef/TLR on 15 November 1943, and as such he became responsible for the development of aircraft and aeronautical equipment. He was regarded as a member of 'Göring's Kindergarten', the small clique of young officers who had been propelled to positions of influence within the RLM in the hope that they would bring fresh ideas and impetus.

In fact, Knemeyer's attempts to initiate an acceptable design for a high-performance fighter powered by a single jet engine went back to the spring of 1944, when the OKL first put out a specification for such a machine with a speed of 1,000km/h and an endurance of 60 minutes at full throttle at an estimated operational altitude of 7,000–9,000m. The service ceiling was to be 14,000m. Armament was to comprise four 30mm MK 108 cannon. The design was to be adequately armour-protected to withstand defensive fire from USAAF 0.5-inch (12.7mm) calibre machine guns and also be equipped with the latest EZ 42 gunsight, auto-pilot and standard radio equipment.

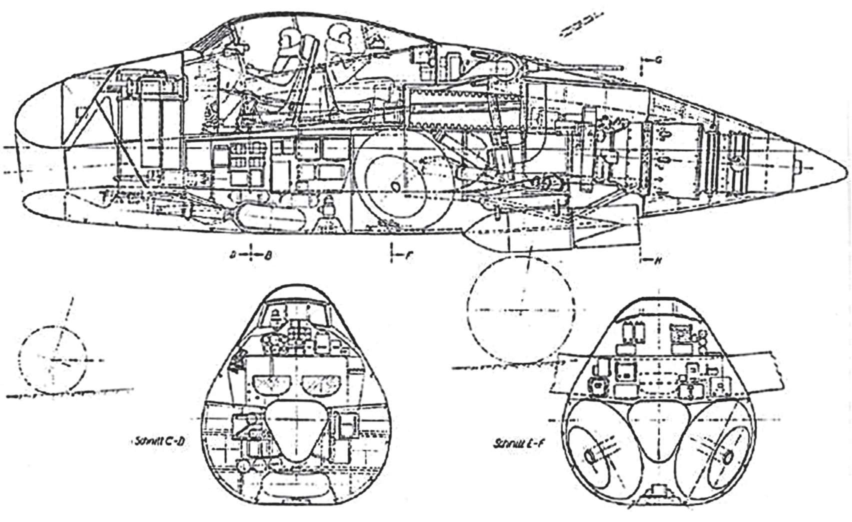
But ongoing delays to the HeS 011 in turn stymied the progress of the airframe manufacturers, and time drifted. However, in a meeting held at Messerschmitt's offices at Oberammergau over 8–10 September 1944, the representatives of Blohm & Voss, Focke-Wulf, Heinkel and Messerschmitt (Junkers became involved in the autumn) unanimously proposed that armament for such an aircraft should take the form of only two 30mm MK 108 cannon, and that it should carry 1,000 litres of fuel.

As it transpired, armament was just about the only area where there was consensus. Inherently, the new design resulted in the manufacturers pushing new boundaries in terms of aerodynamics and speed. This meant that they employed differing methods of calculation, making accurate and meaningful comparison difficult. Junkers' subsequent involvement complicated things further. The Luftwaffe representatives did, however, accept the two MK 108s, but insisted on 60 minutes' endurance, which meant a fuel load of 1,200 litres.

Knemeyer chaired a further, key, 'emergency' meeting at the RLM in Berlin on 15 December 1944 at which the respective designs and progress updates were presented, but there was still no effort at uniformity of calculations, and the various data was again difficult to compare and index. Knemeyer thus called in the DVL at Berlin-Adlershof to act as consultants and advisers in the process. The team was led by Professor Dr-Ing. August Wilhelm Quick, who had worked as head of the development department at Junkers between 1936 and 1939, where he was involved with the design of the Ju 88. He had left Junkers in 1939 to join the DVL, where he became a board member while simultaneously serving at the *Akademie der Luftfahrtforschung* (Academy of Aviation Research). Quick was assisted by Dr P. Höhler. The two men opined that it would take until mid-January 1945 to make a final comparison between the designs based on common methods of calculation.

But at another meeting in Berlin held between 12–15 January, while the DVL confirmed that comparison was finally possible, the RLM played an unexpected hand; it demanded that the single-jet 'emergency' fighter would now need to have an endurance of two hours at full throttle at 9,000m and be fitted with four MK 108s. Obviously, this meant a significant increase in weight as well as a longer takeoff run. Truthfully, however, Knemeyer and his colleagues in the TLR were uncertain that this new requirement could be met.

Over the next six weeks, the whole process fell into a state of wrangling, competing interests, bureaucratic muddling and disagreement that resulted, once again, in delay and uncertainty. Remarkably, however, by February 1945 Knemeyer had received eight project proposals – one each from Blohm & Voss, Heinkel and Junkers, two from Focke-Wulf and three from Messerschmitt. At a 'final' meeting held at the RLM on 27–28 February 1945, Knemeyer and his team carefully assessed the proposals they had received, with a view to making their decision as to which aircraft would be the Luftwaffe's new emergency jet fighter.



Dr-Ing. Richard Vogt used the BV P.212 project as a basis for a heavily armed, advanced, tailless nightfighter, the BV P.215. This aircraft was to be powered by two HeS 011s and carry an array of the latest search radars (the FuG 244, FuG 280 or FuG 350), bad-weather landing aids and navigational direction-finding equipment, together with armament options of four, five or six MK 108 cannon, a remotely controlled FHL 151 gun barbette, as well as no fewer than 56 R4M rockets. It was projected that the BV P.215 would have a maximum speed of 870km/h at 8,500m, with a range of 2,340km.

CHAPTER FOUR

BLOHM & VOSS BV P.212.03

In 1943 the prolific Technical Director and Senior Designer at Blohm & Voss in Hamburg, Dr-Ing. Richard Vogt, commenced work on a series of five radical designs for swept-wing, tailless fighters. The seventh of 12 siblings, Vogt built his first aeroplane at the age of 18, and after graduating from the University of Stuttgart, he joined Dornier in 1923. The Dornier company posted him to Japan for ten years, where he was involved in the design of several Japanese army aircraft. Returning to Germany in 1933, Vogt went on to enjoy a solid career as head engineer within the aircraft department of Blohm & Voss, the famous shipbuilding and engineering firm. Subsequently, from the mid-1930s to 1944, he was responsible for such aircraft designs as the Ha 137 dive-bomber, the BV 141 reconnaissance type and the BV 155 high-altitude fighter, as well as a range of maritime machines such as the BV 138, Ha 140 and the large BV 222 and BV 238 flying boats.

By the time of Oberstleutnant Knemeyer's 'Emergency Fighter' requirement in late 1944, Vogt was not in the best frame of mind. His ire had been provoked during September as a result of the biased way in which another tender process – that for the proposed '*Volksjäger*', a cheap and quick-to-build fighter powered by a single BMW 003 jet engine and capable of being flown by pilots with limited flight experience from makeshift airfields – had been handled clumsily in favour of Heinkel (the eventual winner). Notwithstanding that,

The highly experienced Dr-Ing. Richard Vogt, the Technical Director and Chief Designer at Blohm & Voss, was responsible for a series of radical, tailless designs for jet-powered fighters during 1944. His originality and ingenuity was seen in several earlier designs such as the BV 141 reconnaissance machine, with its asymmetrical gondola and tailplane, and the large BV 222 and BV 238 flying boats.

however, Vogt duly complied with Knemeyer's request and submitted a project known as the BV P(for *Projekt*) 212.03, a deep, stubby-fuselage jet fighter with a dramatic, 40-degree swept-back wing at quarter chord, incorporating pronounced dihedral.

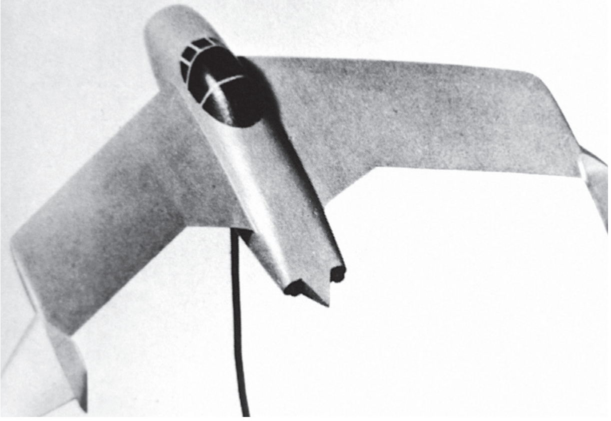
The design lineage of the P.212.03 went back to the P.208 that Vogt planned for a high-power piston engine such as the much-vaunted, but ultimately disappointing, Jumo 222 E (in the 208.01), the 4,000hp water-cooled, 24-cylinder Argus AS 413 (in the 208.02) or the planned Daimler-Benz DB 603L with two-stage supercharger (in the 208.03). However, the P.208 was quickly superseded by the tailless P.209.01 of November 1944, which broadly replicated the P.208 but incorporated an HeS 011 jet engine that was built into the rear of the short fuselage. It had a wing area of 13sq m. As such, it was estimated that the P.209.01 would have been capable of a maximum speed of 990km/h at 8,840m. The aircraft was to have been fitted with two 30mm MK 108 cannon. The P.210.01 of December 1944 was similar to the P.209.01, but it was to be powered by a BMW 003 and featured a larger wing of 14.9sq m.

Vogt's final design in the series was the BV P.212, which was developed in detail under his supervision at Blohm & Voss's subsidiary, Hamburger Flugzeugbau, at Hamburg-Finkenwerder. It would be this design that Vogt submitted to Knemeyer as a prospective Emergency Fighter design. The P.212 was similar to the P.210, but like the P.209 it was to be powered by an HeS 011 and incorporated a pressurised cockpit with a bubble canopy for all-round vision. Main- and nosewheels retracted forward, with the main undercarriage resting on the fuselage beams. The wings were skinned in stressed steel, as was Dr Vogt's custom, and contained the fuel tanks, although he allowed for wood or aluminium to be used for the wings as alternative materials. The wing tanks could accommodate 820 litres of fuel unprotected and 150 litres protected. A further fuel tank, of 400 litres, was built into the fuselage between the cockpit and the engine. Standard armament comprised two MK 108s (100rpg), one gun on either side of the cockpit, but provision existed to fit a third MK 108 (60 rounds) directly in front the cabin.

For control purposes, the aircraft was to have featured particularly deep trailing edge flaps with very short-span ailerons, and the leading edges of the wings also had full-span slats.

The air intake was in the nose, and the short, steel duct ran through the fuselage to the compressor of the HeS 011 in the tail. The duct featured a slight curvature to allow space for the pressurised cockpit, which was built into the front third of the fuselage. This duct also served as the fuselage inner load-bearing member and it widened into a double crossbeam, the wing being attached to it and with the engine mounted to the rear. The elevators were downswept. On 9 January 1945, officials from the DVL reported that in their view the P.212.02, without question, needed some form of vertical rudder.

An alternative armament of two batteries of 22 55mm R4M solid fuel-propelled, fin stabilised, air-to-air rockets could be fitted under the wings (11 per wing), which would have replaced the MK 108s.



A wooden model of one of Blohm & Voss's early tailless jet designs, showing a swept-back wing with dihedral, small tails and vertical rudders, which became a feature of the BV P.208, 209, 210, 212 and 215 projects.

On 15 February 1945, on receipt of the BV P.212 project proposal, Knemeyer requested that Blohm & Voss check the strength of the outer wing and fin sections as well as the materials intended to be used in the building of the aircraft. On 23 February, after discussions between the RLM and Blohm & Voss, a production plan for an initial run of three aircraft was drawn up, in which the first prototype, the V1, was to be completed by mid-August 1945, with the V2 following on in September. Blohm & Voss also prepared for wind tunnel-testing.

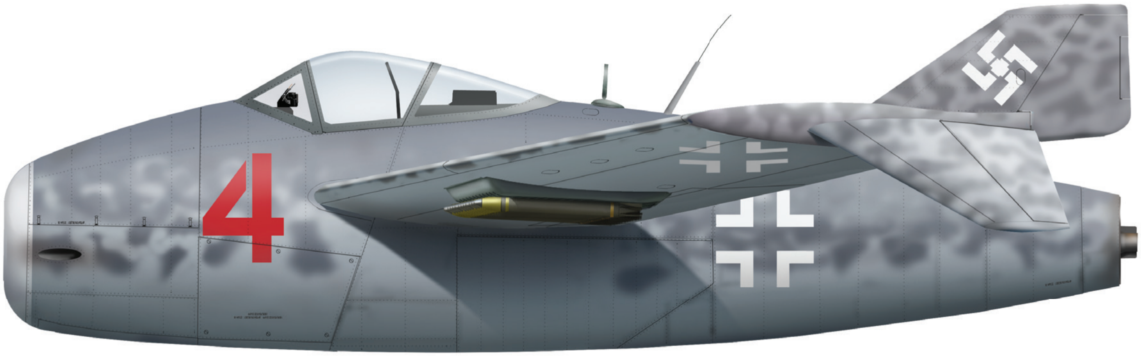
At Finkenwerder, work continued on a P.212.01 and .02, but these projects were scrubbed when design commenced on the P.212.03, which was to feature a lengthened fuselage and improved manoeuvrability and handling in flight as a result of the redesigned vertical rudders suggested by the DVL. Furthermore, in order to eliminate any concern over flutter arising from the concentration of mass at the wing tips, the wingspan was shortened by 2.5m against the P.212.02 and the sweep-back reduced from 45 degrees to 40 degrees. Additionally, by increasing the wing chord, the resulting greater takeoff weight allowed an increase in fuel capacity to 2,400 litres (2,100 litres internally and 300 litres in two underwing drop tanks), with an endurance of around four hours. Heavier weapons options included extra fitments for up to seven MK 108s or one of the anticipated 55mm Rheinmetall-Borsig MK 112 cannon (essentially a more powerful MK 108) and two MK 108s, or the fitting of a pair of MK 108s in addition to 22 R4Ms.

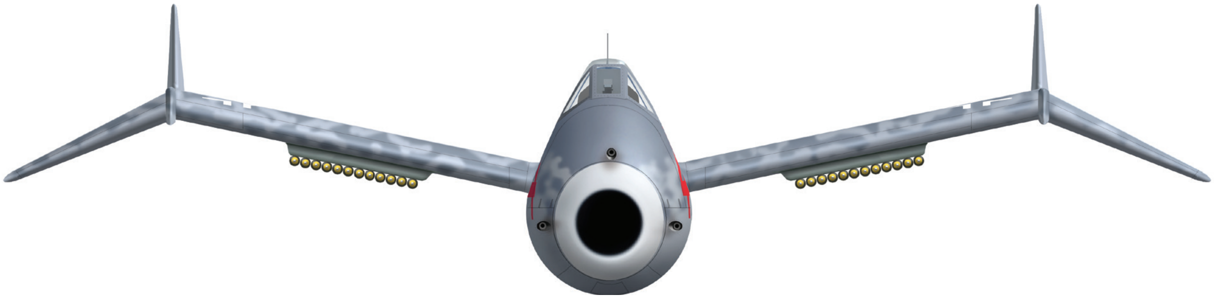
In mid-April 1945, however, with no contract forthcoming from the RLM, Blohm & Voss eventually ceased any further the development on the P.212.

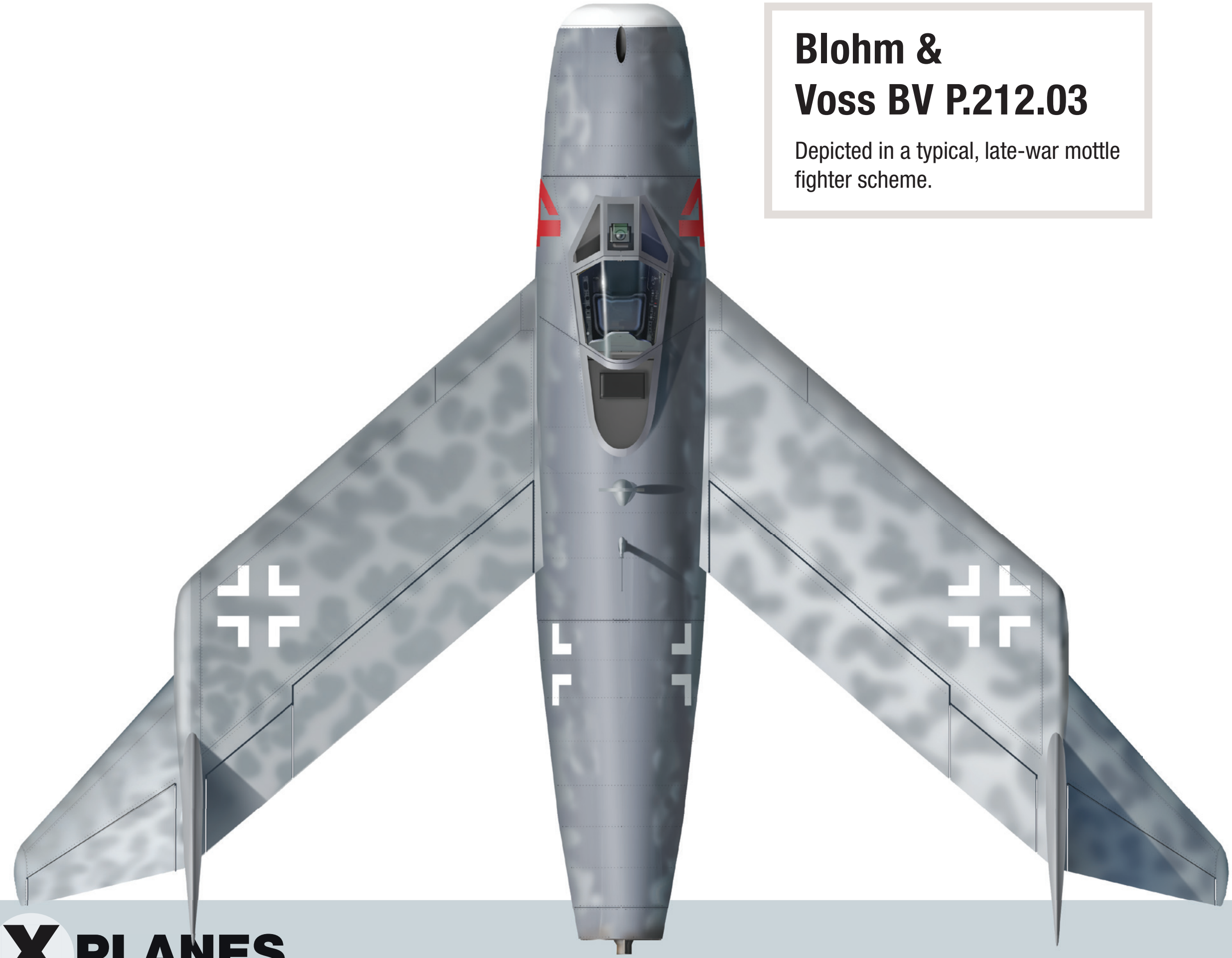
CANNON AND ROCKET ARMAMENT

With the advent of massed American daylight bomber formations and their concentrated defensive firepower, the need arose for a long-range, heavy-calibre gun with which a German pilot could target specific bombers, expend the least amount of ammunition, score a kill in the shortest possible time and yet stay beyond the range of the enemy's guns. It was a virtually impossible requirement but the 30mm MK 108 cannon almost achieved this.

First designed in 1940 by Rheinmetall-Borsig, the prime benefit of this weapon, used profusely by the Luftwaffe for close-range, anti-bomber work over northwest and southern Europe from early 1942 onwards, lay in its simplicity and economic process of manufacture, the greater part of its components consisting of pressed sheet metal stampings. Indeed, the MK 108 was a triumph in weapons engineering, not only saving precious materials but







Blohm & Voss BV P.212.03

Depicted in a typical, late-war mottle fighter scheme.

also hundreds of man-hours on milling machines and precision grinders.

The MK 108 was a blowback-operated, rear-seared, belt-fed cannon, using electric ignition, being charged and triggered by compressed air, though once installed into any aircraft there was no method of adjustment for harmonisation. One of the most unusual physical features of the gun was its extremely short barrel, which gave it its low muzzle velocity of between 500 and 540m/sec, with a maximum rate of fire of 650 rounds per minute (rpm). At only half the weight of the MK 103 wing-mounted cannon, two MK 108s represented the same payload but had a combined rate of fire slightly more than three times that of a single MK 103. The weapon was subsequently integrated into the later variants of the Bf 109 and the Fw 190A-8, where it quickly earned a fearsome reputation amongst Luftwaffe pilots and Allied bomber crews, who dubbed it the ‘pneumatic hammer’.

A total of 60 rounds was fed by means of a disintegrating belt from an ammunition can mounted above the gun. Two basic types of shells could be loaded into the MK 108 – the 30mm high-explosive, self-destroying, tracer type shell designed to cause blast effect and the 30mm high-explosive, self-destroying incendiary shell intended to cause both blast and incendiary effect. In consultation with the Luftwaffe’s principal test centre at Rechlin, ballistics specialists at Rheinmetall-Borsig’s main testing ground at Unterlüss had calculated that maximum destruction to an enemy aircraft could be created by causing the largest possible explosive effect in its interior, but that this in turn was dictated by the size of the enemy aircraft and by the quantity of explosive that could physically be placed into a projectile. The thicker the shell wall, the more energy was needed for the destruction of the shell itself, and thus, less energy remained for the destruction of the target by the ensuing explosion. This theory led to the development of the ‘Mine Shell’, which combined a minimum thickness in shell casing with a maximum load of explosive. Using such ammunition, the entire enemy aircraft could be regarded as the target area, it making no difference where the hit was actually made. As such, with Mine Shells a fighter pilot had an inherently greater chance of scoring a kill.

Following tests carried out at Rechlin, it was discovered that five hits from a 30mm Mine Shell carrying 85g of explosive were needed for the destruction of either a B-17 Flying Fortress or B-24 Liberator.

Incendiary shells were also considered an extremely potent form of ammunition, but only really effective when targeted at fuel tanks. The vulnerability of an enemy aircraft could therefore be measured by the area/size of its tanks. However, a certain degree of penetrative force was still needed in order to break through the airframe or any protective armour carried by the target without breaking up and igniting until actually striking the fuel. To overcome this problem, the 30mm incendiary shell was fitted with a hydrodynamic fuse that activated only when making contact with a fluid.

When attacked by a fighter directly from behind, the area of a B-17

Flying Fortress taken up by its fuel tanks was approximately one-fifth of the total, and it was assumed that by the time an attack was made the tanks would be half empty. Thus, in combat conditions, this area was reduced to one-tenth of surface area. It was calculated that between five and ten 30mm incendiary shells were needed to cause inextinguishable burning. However, in the case of B-24 Liberators, an effective attack using incendiaries was slightly more difficult since the bomber's main fuel tanks were located in the fuselage, with only reserve tanks located in the wings behind the engines.

For most of 1944, German ballistics engineers had recognised that air-to-air rockets would be needed, since extending the range of fixed armament was difficult. Furthermore, Allied bombers had increased their defensive firepower, meaning close-range attacks were becoming more challenging.

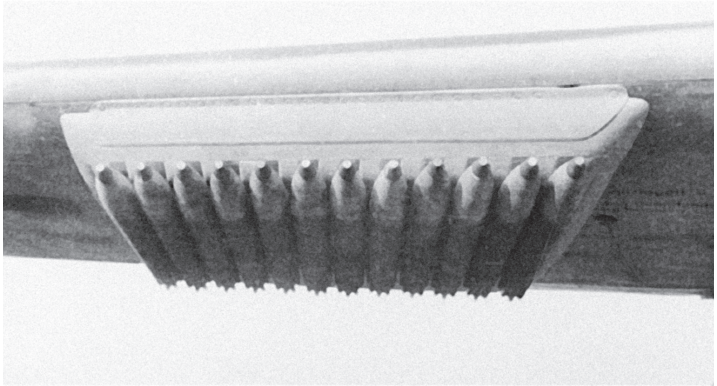
Throughout the latter half of 1943 and into 1944, the mixed success of the W.Gr.21cm air-to-air mortar meant that the only plausible alternative was for a group of fighters to attack a bomber formation simultaneously firing batteries of rockets carried either in underwing racks or in nose-mounted 'honeycombs'.

A dense 'fire-chain' could be created with such weapons, making it impossible for the bombers to avoid being hit. In June 1944, a requirement was put forward by the Luftwaffe's Technical Office for an electrically fired, fin-stabilised weapon whose warhead would contain sufficient explosive to destroy a four-engined bomber in one hit. Four weeks later, a powerful consortium of companies, each with individual responsibility for different components, was formed and led by the Research Institute of the Deutsches Waffen und Munitions Fabrik (DWM) of Lübeck.

This consortium duly came up with a proposal for an 814mm long, 55mm calibre rocket with a warhead containing 520g of explosive and ignited by an AZR 2 detonator, all bearing a weight of 3,500g. The rocket was intended to be launched against aerial targets from a range of 800m and be stabilised by eight fins that would open automatically by aerodynamic drag immediately after launching.

The proposal was received favourably and the designation 'R4M' (Rakete 4kg Minenkopf) applied to the project. Firing trials took place at the end of October 1944 on the Strehla range at the Westin works of Brünn AG and at DWM's partner, the Curt Heber Maschinenfabrik (HEMAF) at Osterode. However, the Luftwaffe test centres at Rechlin (which conducted the first aerial launches in December 1944) and Tarnewitz both judged that the missile was still unsatisfactory as a result of the poor standard of manufacture of some individual parts. By the end of January 1945, once some initial burn-out problems had been solved, a general re-working of the rocket, incorporating various aerodynamic and warhead refinements, was conducted.

In its final form, the R4M appeared as an unrotated, rail or tube-launched, single venturi, solid fuel propelled, multi-fin stabilised missile, with the warhead contained in an exceptionally thin 1mm sheet steel case



A wooden launch rack fitted to the underside starboard wing of an Me 262 of JG 7 armed with a battery of 12 55mm R4M rockets. Weighing just over 20kg, additional rails could be fitted if practical. To load the rack, each rocket was pushed along the guide-rail until its rear sliding lug was arrested by a notch in the rail. The R4M was planned as a standard weapon for use on most of the emergency fighter designs of late 1944 and intended for use against enemy bomber formations.

enclosed in two pressed steel sections welded together and holding the Hexogen high-explosive charge. The missile bore a high charge-weight to case-weight ratio.

The R4M, also known as the Orkan (Hurricane), was intended to launch from the Me 262 jet fighter, from wooden underwing racks, mounted by four screws and positioned outside of the engines, with the connections between the launch rack and the wing surface faired in to counteract the possibility of air eddies as much as possible.

The standard launch rack – known as the EG.-R4M – measured approximately 700mm in length, with each rocket being fitted with sliding lugs so that it could hang freely from the guide rails. Prior to loading into the rack, seven of the R4M's eight fins were held in a folded-down position by binding them with spring-steel wire made with spherical or similarly thickened ends. The wire ends were then crossed and the eighth (free) fin pressed down to hold the other seven in place. Each rocket was then loaded from the rear of the rack, with the eighth fin held in place by the rail securing the wire binding. The rocket was pushed along the guide rail until the rear sliding lug was arrested by a notch in the rail. At the back of each rail was a terminal contact block connecting the ignition wires that hung down close to the socket. Once fired, the eighth fin was designed to spring free, which, in turn, released the binding wire, thus allowing the remaining seven fins to open – a process which commenced at about 400mm from the rail and finished once the rocket had flown approximately 2.5m.

As many rails as desired could be fitted together to make one launch rack by means of transverse connection, with a gap of 65mm between each rail, although it was usual to carry a maximum load of 12 R4Ms under each wing of the Me 262 using a 21kg rack. It was calculated that the loss of speed incurred to an Me 262 as a result of a Heber launch rack being fitted was approximately 16km/h.

The R4M was deployed operationally on the Me 262 from March 1945 by JG 7, and from April by JV 44. It met with moderate success, though accuracy was always a problem. Some USAAF bombers were brought down by rockets but, ultimately, like the W.Gr.21 mortar, the value of the R4M lay in its ability to panic, break up and scatter enemy bomber formations, thus neutralising their defensive firepower and allowing closer-range attacks by individual and smaller groups of fighters.

CHAPTER FIVE

FOCKE-WULF *PROJEKT 'HUCKEBEIN'*

Prof. Dr-Ing. Kurt Tank, the Chief Executive and Technical Director of Focke-Wulf, and the creative mind behind many classic aircraft of the war years, including the Fw 190, Fw 200 and Ta 152. He first considered the notion of a single-engined, jet-powered interceptor in 1943. After the war he would take up the design once again, for use in Argentina.

The origins of what became the Ta 183 jet fighter stretched back to March 1943, when Professor Kurt Tank, the Chief Executive and Technical Director of Focke-Wulf at Bremen, and members of his *Entwurfsbüro* (Project Office), devised a new set of seven design studies, classified as *Entwurf* 1 to 7, for a single-seat day fighter to be powered by a single jet engine based on the Jumo 004. After a series of changes and alterations to the initial *Entwürfe*, *Entwurf* 5 of this ongoing set was issued in January 1944 and contained two specification proposals for a new fighter that became known as Plan V (P V) and Plan VI (P VI). The former was intended as a high-altitude aircraft powered by an HeS 011A, while Plan VI took the form of a short-fuselage fighter with swept-back wings again powered by an HeS 011, but this time supplemented by a 1,000kg-thrust bi-fuel rocket motor installed above and slightly behind the turbojet unit. This additional source of power was intended to enhance performance for up to 200 seconds during interception missions. Fuel for the rocket motor was to be carried in underwing drop tanks.

Tank's rationale was spelled out in a Focke-Wulf report of late 1943:

'With the HeS 011 engine we have at our disposal for the first time a jet engine with which it seems possible to construct a single-engine jet fighter which, in performance, can compete with existing twin-engine jet fighters and with the best piston engine fighters. Though it is possible to reach comparatively high velocities with smaller engines, the climb performance will remain somewhat unsatisfactory.

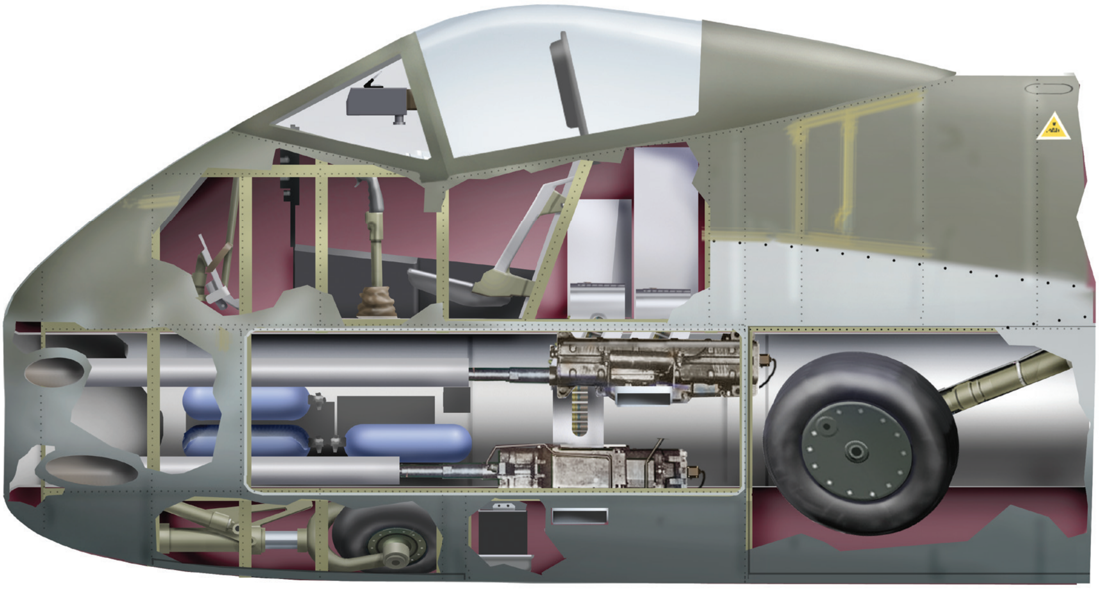
'For the design layout of the jet fighter, the range of altitudes for which optimal performance is needed is of prime importance. Considering the enemy bombers and fighters with high-operating altitudes (B-29, Mosquito, Thunderbolt, Lightning) which are to be expected in the next year, we thought it advisable to stress performance and qualities in the range of altitudes from 8,000 to 14,000m. If we aim for high velocity, this means that first of all we must try to raise the critical Mach number as much as possible. The minimising of the drag area of the aircraft in the domain of small Mach numbers, which normally is the alpha and omega of all performance increase from the aerodynamic point of view, is only of secondary importance. This can be seen when we plot the thrust delivered by the engine divided by stagnation pressure versus Mach number.

'As for climb performance, the requirement of high operational altitudes means first of all that we must aim at a high ceiling which is obtained by choosing a relatively large wingspan and thereby also wing area. The weight of the wings is thereby increased, and hence the rate of climb at sea level is slightly smaller, but the total time to climb to a height of around 10km and more will be lessened. It must, however, be emphasised that the increase of the ceiling in the stratosphere requires an unusually high expense. Additional equipment, for which there is space, will, naturally, have to be paid for in altitude at the rate of about 1m for 0.5kg of excess weight. On the other hand, an increase in ceiling and, therefore, also in operational altitude of about 1,000m will follow from the increase in engine performance which is expected from the HeS 011B model.

'For use as an interceptor, there is provision for the installation of an R-Gerät (auxiliary rocket-boost motor) of 1,000kg thrust which would make possible a climb of 10,000m in four minutes. The necessary fuel, weighing 1,460kg, would be carried in two external fuel tanks. Hence this particular tactic [interception] can be taken care of by additional equipment. For tactical deployment as a fighter-bomber, a bomb-load of 500kg may be carried in the fuselage in such a way that the bombs protrude only about halfway out of the fuselage.

'Because of the high performance, armament would be restricted to two MK 108s with 100rpg. With a sacrifice of around 600m in ceiling, two additional MK 108s with 60rpg could easily be installed.'

When the RLM reviewed P VI, its representatives were reasonably impressed and ordered that development of the design should be continued and referred to officially, but somewhat confusingly, as the *Entwurf* 2 (the earlier 1943 design having been cancelled). To start with, Focke-Wulf used the RLM allocation of Fw 232 for the new design, but '232' was already being used by Arado for its transport machine of the same number and so the ministry assigned the number '183' to the project. It also decided to prefix this number with the letters 'Ta', denoting, like the Ta 152 and Ta 154 before it, a design in honour of Kurt Tank.



Inside the Focke-Wulf Ta 183 Ra-4

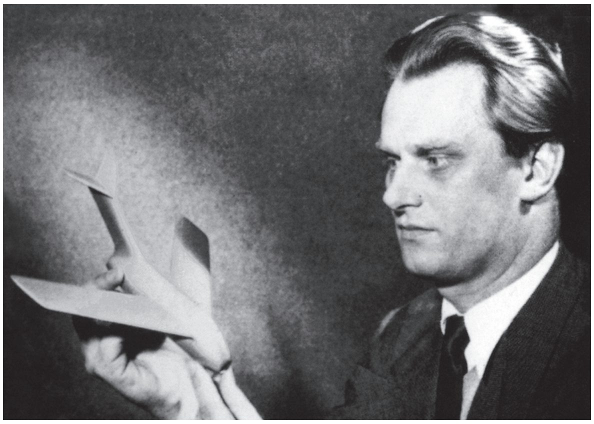
The Ta 183 forward section. The all-round vision canopy covered a pressurised cockpit that was armour-protected to withstand 12.7mm ammunition from ahead and 20mm rounds from behind. Flight controls were located on the left side of the instrument panel, while engine and radio controls were to the right. Directly ahead of the pilot was an EZ 42 gyroscopic gunsight. Radio equipment consisted of a FuG 16ZY VHF transceiver and a FuG 25a Erstling IFF, installed on this plan beneath the cockpit, while on other plans it was located immediately aft of it. This was fitted next to a FuG 125 Hermine direction finder.

Four 30mm MK 108 cannon could be installed in pairs on either side of the cockpit, with ammunition containers above (100 and 125rpg). The aircraft could be fitted with an SC 500 bomb (as shown) or a BT 200 aerial torpedo.

The nosewheel retracted to the rear, while the mainwheel went in forward. A battery unit was built in just behind the nosewheel. A fuel tank is visible in the lower fuselage.

At this point, day-to-day responsibility for the design development of the Ta 183 was placed under the auspices of one of Tank's most capable assistants in the *Entwurfsbüro*, Dipl.-Ing. Hans Multhopp. Born in Alfeld in 1913, Multhopp was a softly spoken aerodynamics expert who had qualified with a degree in aeronautical engineering from the University of Göttingen where one of his tutors, the acclaimed aerodynamicist Ludwig Prandtl, regarded him as his best student. After being placed in charge of the wind tunnels at the *Aerodynamische Versuchsanstalt* (AVA) at Göttingen in 1937, he was approached the following year by Tank, who offered him a position at Focke-Wulf.

During the war years, Multhopp was behind a number of inventive proposals. In late 1940 he designed an ingenious form of combined landing flap and dive brake, which became known as the 'Multhopp Klappe' for use in, amongst other things, the planned high-performance Fw 191 medium bomber. He was also involved in calculations for the 'Doppelhaube' ducted spinner, intended for the Fw 190 and which was hoped would reduce the aerodynamic losses experienced from the large frontal area of a radial engine of the kind which powered that fighter. For the same aircraft he also proposed a swept-back wing, in

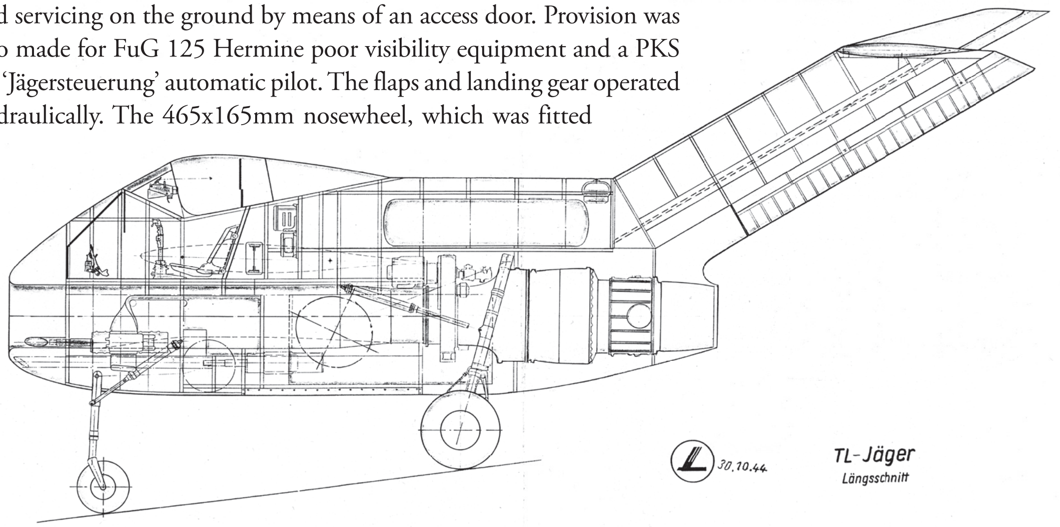


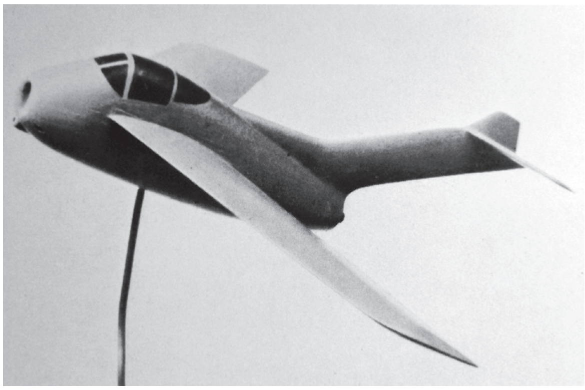
Hans Multhopp examines a wooden model of the Ta 183. A gifted aerodynamicist, Multhopp worked to turn Kurt Tank's vision for the Ta 183 into a reality. Despite working within the constrictions of the crumbling Third Reich, he managed to design an aircraft that provided inspiration for several post-war designs. The British considered him 'arrogant', but he worked in America for several years after the war, where he died at the age of 59 in 1964.

which the small, inner section of the wing was actually swept forward, while the larger, outer section would be swept back by 25 degrees, this arrangement being seen as maintaining the Fw 190's centre of gravity.

In the case of the Ta 183, Multhopp had recognised that in the foreseeable future, aircraft operating in the lower supersonic levels would need swept-back wings with less thickness in order to push the shock waves outward as the aircraft neared the speed of sound at high Mach numbers. Multhopp planned four potential variants of the Ta 183, all of which were assigned Rechnerische Ankündigung (in effect, 'calculation model') or 'Ra' suffixes. The Ta 183 Ra-1 was fitted with an HeS 011R, this version of the Heinkel engine being supplemented by the aforementioned rocket motor. The Ta 183 Ra-2 was similar but had an increased wingspan and was powered by a Jumo 004, while the Ra-3 incorporated the HeS 011, less the rocket motor. Finally, the Ta 183 Ra-4 was similar in layout, but was to carry the HeS 011A main production engine.

The design took the form of a short, mid-wing aircraft with an oval cross-section fuselage and with thin wings swept back 40 degrees at quarter chord. With a fuselage length of 8.90m, the turbojet sat to the rear of the aircraft and was accessible for maintenance on the ground by removable panels. An air intake duct led directly to the engine from the nose, which, unlike the Blohm & Voss design, was straight even though the pressurised cockpit was housed just above it. The cockpit had a bubble canopy for all-round vision and was armour-protected to withstand 12.7mm ammunition from ahead and 20mm rounds from behind. Flight controls were located on the left side of the instrument panel, while engine controls and radio were to the right. Radio equipment consisted of a FuG 16ZY VHF transceiver and a FuG 25a Erstling IFF installed behind the cockpit and accessible for adjustment and servicing on the ground by means of an access door. Provision was also made for FuG 125 Hermine poor visibility equipment and a PKS 12 'Jägersteuerung' automatic pilot. The flaps and landing gear operated hydraulically. The 465x165mm nosewheel, which was fitted





A wooden model of the Ta 183 demonstrates the design's short fuselage, swept-back wings and tail area, faired in cockpit and intake duct.

to a single strut and an angled fork, retracted to the rear into a bay just beneath the intake, while the single-strut mainwheels, measuring 700x175mm, were raised in forwards and were fitted with shock absorbers, planned to be those used on the Fw 190. The gear was enclosed by a hinged cowl.

The tail fin was tall and swept back by 60 degrees, and a swept-back tailplane was mounted in a dihedral form at the top of the fin. The fin was attached to the upper fuselage frame with three bolts.

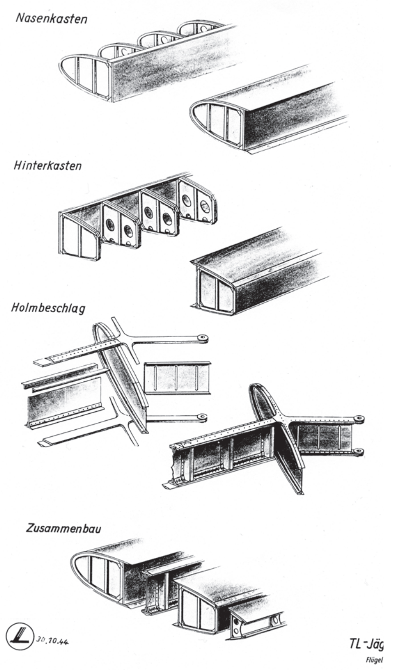
But the reality was that by 1944, no matter how good the design, the problem was the supply – or lack thereof – of high-grade materials. Therefore, Focke-Wulf was forced to revert to using wood for the construction of the wing, with the main box spar made of duralumin I-beams with steel flanges, the whole being fixed to the fuselage by a single bolt. The wing-fuselage attachment was by means of four bolts on the two root bulkheads.

A single sheet skin of plywood was used to cover the wing and leading edge from fuselage to tip. The wing had no large doors other than a few hand-lock cover plates. The main material used in building the aircraft was steel (40 per cent), wood (23 per cent) and duralumin (21 per cent). The fuselage used steel and aluminium for its upper section and engine fairing, the rest being in duralumin. The engine covering on the lower section of the fuselage was detachable. The nose cap and intake duct were of aluminium. Gluing, riveting and welding were employed for attachment. Control surfaces comprised ailerons and trailing edge landing flaps. Pitch and roll control would be provided by wing elevons, while the tailplane, which was electrically operated, was used for trimming. Extension and retraction of the landing flaps was carried out hydraulically. The fin was of aluminium and swept back 60 degrees, while the horizontal stabiliser, with a sweep of 40 degrees, was again made up of wooden ribs and formers sheeted in plywood. The fuselage fuel tank would carry 1,000 litres, while the six, leak-proof light metal tanks in each wing would take 1,565 litres. The fuselage tank was to be protected by a 15mm steel armour plate at the rear and by 3mm steel deflector plating along the sides and top. The front end was to be protected by the cockpit armour plating.

Fuel flow was accomplished automatically, without the use of a selector valve, in such a way that by means of compressed air newly loaded fuel was forced from the tank to be emptied first (tank 1), through all the following (tanks 2–5) into the intermediate feed tank (tank 6), and the fuel was then forced by the same pressure into the fuselage feed tank. Fuel intake occurred in the reverse order.

Despite the use of some inferior products in its construction, for most of 1944 Multhopp and his colleagues in the *Entwurfsbüro*, which had relocated from Bremen to alternative quarters at the Badehotel

OPPOSITE Focke-Wulf profile drawing of the Ta 183 from 30 October 1944. The cockpit area shows the fitment of an EZ 42 gunsight, control column, pilot's seat, rudder controls and radio equipment, while below and to the side of the intake duct is one of two MK 108 cannon. Provision for a further two such weapons can be seen behind and below. The mainwheels are shown retracting forward and a fuel tank sits above the HeS 011 engine. The compass is installed between the fuselage fuel tank and the base of the tail fin.


Nasenkasten
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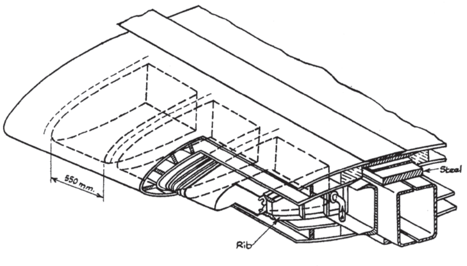
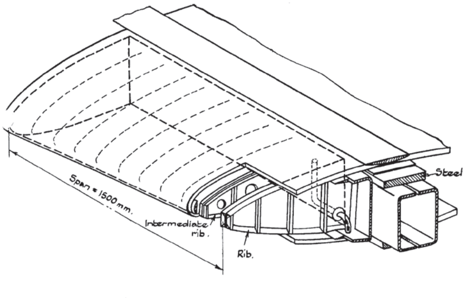
TL-Jäg
Flügel


550 mm.
Rib
Steel

Wing detail showing sheet aluminium tanks.


Span = 1500 mm.
Intermediate rib.
Rib.
Steel

Wing detail, showing use of wood.

Focke - Wulf Model 183.

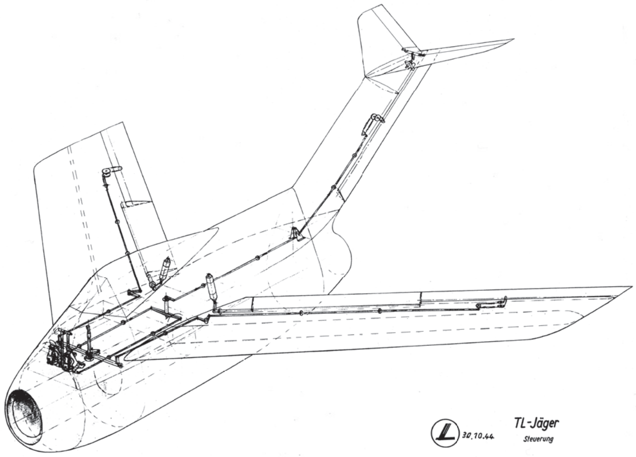
LEFT Two drawings from a British intelligence report showing the construction of the Ta 183 wing, with the fuel tanks located close to the leading edge, the method of wood skinning and the steel flange above the duraluminium spar.

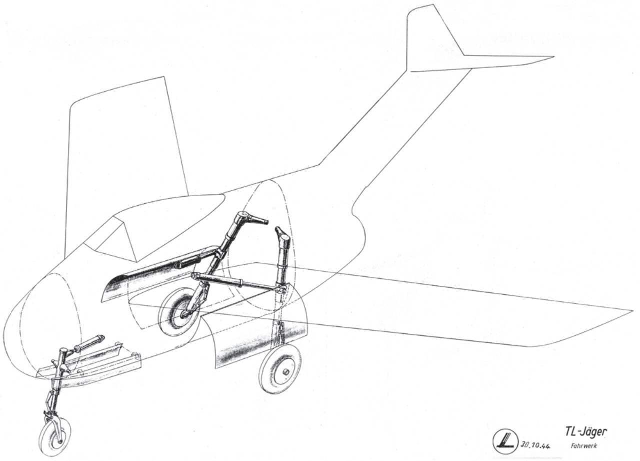
FAR LEFT A selection of views showing the internal build of the wing, including the leading and trailing edges and the root join.

in Bad Eilsen, worked doggedly to evolve the Ta 183 into a new generation, easy-to-build, yet state-of-the-art jet interceptor, intended primarily for combatting heavy bombers with speed and firepower. The latter was provided by two 30mm MK 108 cannon with 120 rounds each mounted in the nose either side of the intake, with the option for a further pair of MK 108s (100rpg) or 30mm MK 103s (110rpg). Access to the armament and the ammunition boxes was through a large door on the fuselage side. The ammunition boxes were removable and the belts could be loaded outside the aircraft. Boxes for additional guns were rigidly installed and could be loaded through the fuselage doors. The pilot would also have the Askania EZ 42 gyroscopic gunsight, which had been used with considerable effect in the Fw 190 and Me 262.

BELOW LEFT The control rod system for the Ta 183 showing the rods running from the cockpit to the wing control surfaces and the rudder and horizontal stabilisers.

BELOW A Focke-Wulf sketch from October 1944 that shows the installation of the nosewheel and main undercarriage of the Ta 183.


30.10.44
TL-Jäger
Steuerung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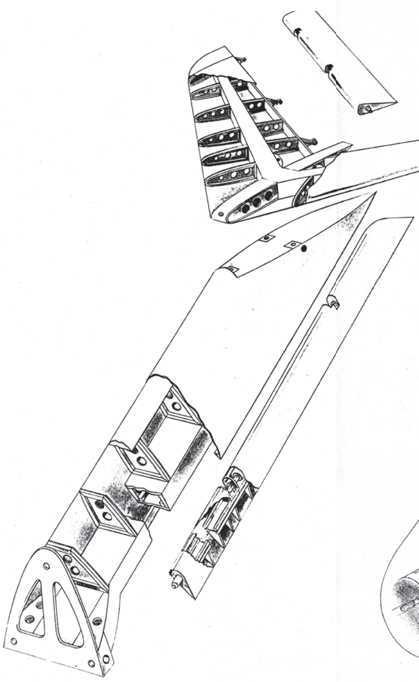
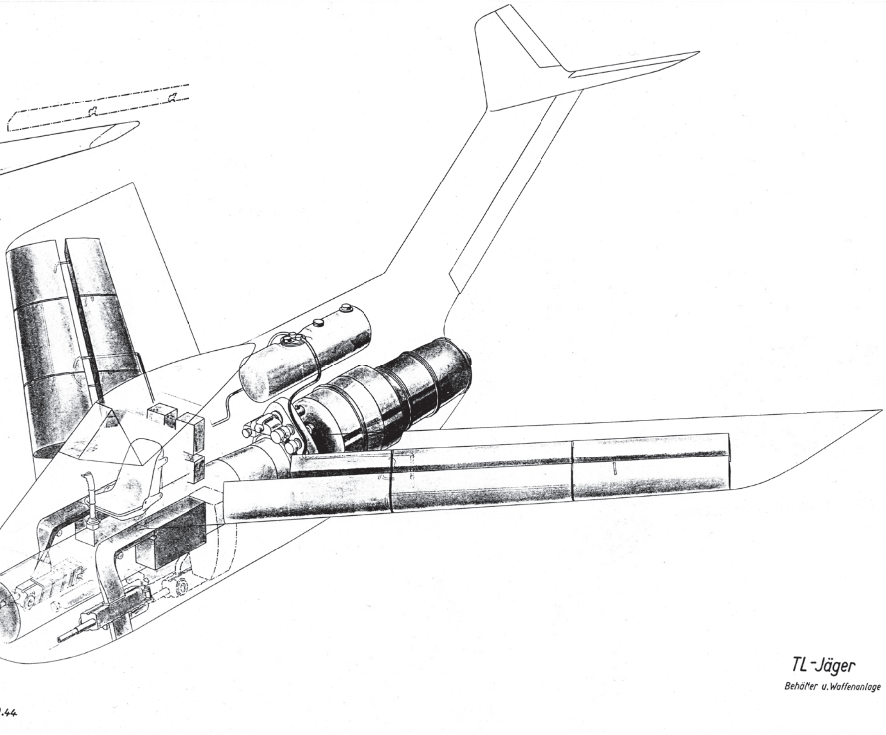
TL-Jäger
Fahrwerk





ABOVE Exploded view of the Ta 183 tail assembly showing the internal construction of the fin, rudder and horizontal stabiliser.

ABOVE RIGHT This sketch of the Ta 183 from October 1944 shows the wing and fuselage fuel tanks, the intake duct and casing for the HeS 011 engine, the two 30mm MK 108 cannon installed in the nose together with ammunition feed chutes and boxes, and the area for radio equipment immediately behind the pilot's seat.

A small number of 1:10 scale models of the Ta 183 were built by Ing. Ulrich Stampa, a Focke-Wulf mechanic specialising in wood and metal control surfaces, and hydraulics. Powered by small firework rockets, they were used to conduct 'flight tests'. Multhopp's design, when transformed into a model, performed well, but did suffer from a tendency to fall into a 'wiggling motion' as it yawed and rolled simultaneously. A report on the models' handling characteristics, prepared by Gotthold Mathias, another engineer at Focke-Wulf, was not positive and the 'Dutch roll' problem was not solved until significant adjustments had been made to the elevators.

Multhopp's design was described in detail by Dipl.-Ing. Dietrich Fiecke, an employee of the Henschel firm who also advised the DVL:

'The design's straightforward swept wing was a good way to achieve high speeds. The poor ratio of slenderness of the fuselage and the bulbous nose could lead to compression shocks at even relatively low speeds, resulting in a large increase in drag. The cockpit layout provided good visibility. The air intake opening and the straight flow of air to the engine was probably the best solution given the location of the engine. The large surface area of the swept and upward protruding tail fin caused an enormous amount of drag build-up. The comparatively short takeoff runs and low landing speeds shown in the calculations were based on the large wing surface area. The low wing loading proved extremely beneficial in this area as well.'

Multhopp christened the project '*Huckebein*' after the raven in Wilhelm Busch's story *Hans Huckebein, der Unglücksrabe*, first published in 1867. It is the tale of an unruly and disruptive raven that wreaks havoc in the house of a young boy and his aunt, antagonising

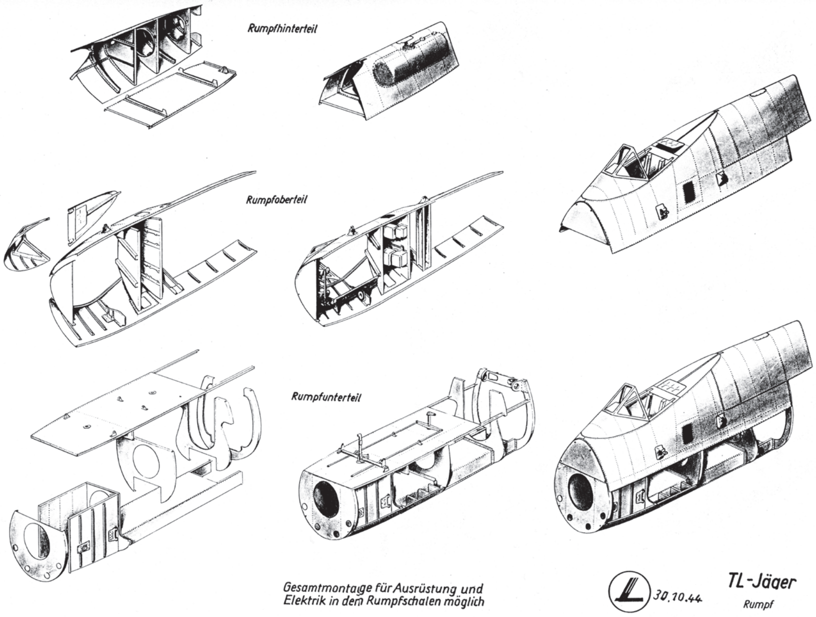
his human, canine and feline victims and breaking crockery. In some way, this was felt to be an appropriate name.

But Multhopp's progress was frustrated by the ongoing production difficulties associated with the HeS 011. The compressor assembly on the engine was proving the main source of trouble. Indeed, following tests at the AVA at Göttingen, the engine was generally considered to be a poor performer. As a result, Heinkel carried out a major redesign for what was foreseen as the production model in an effort to make mass manufacture, which was scheduled for March 1945, simpler. However, any hope Focke-Wulf may have had of falling back on the Jumo 004 soon evaporated as this engine was required for the Me 262, which was now reaching Luftwaffe units.

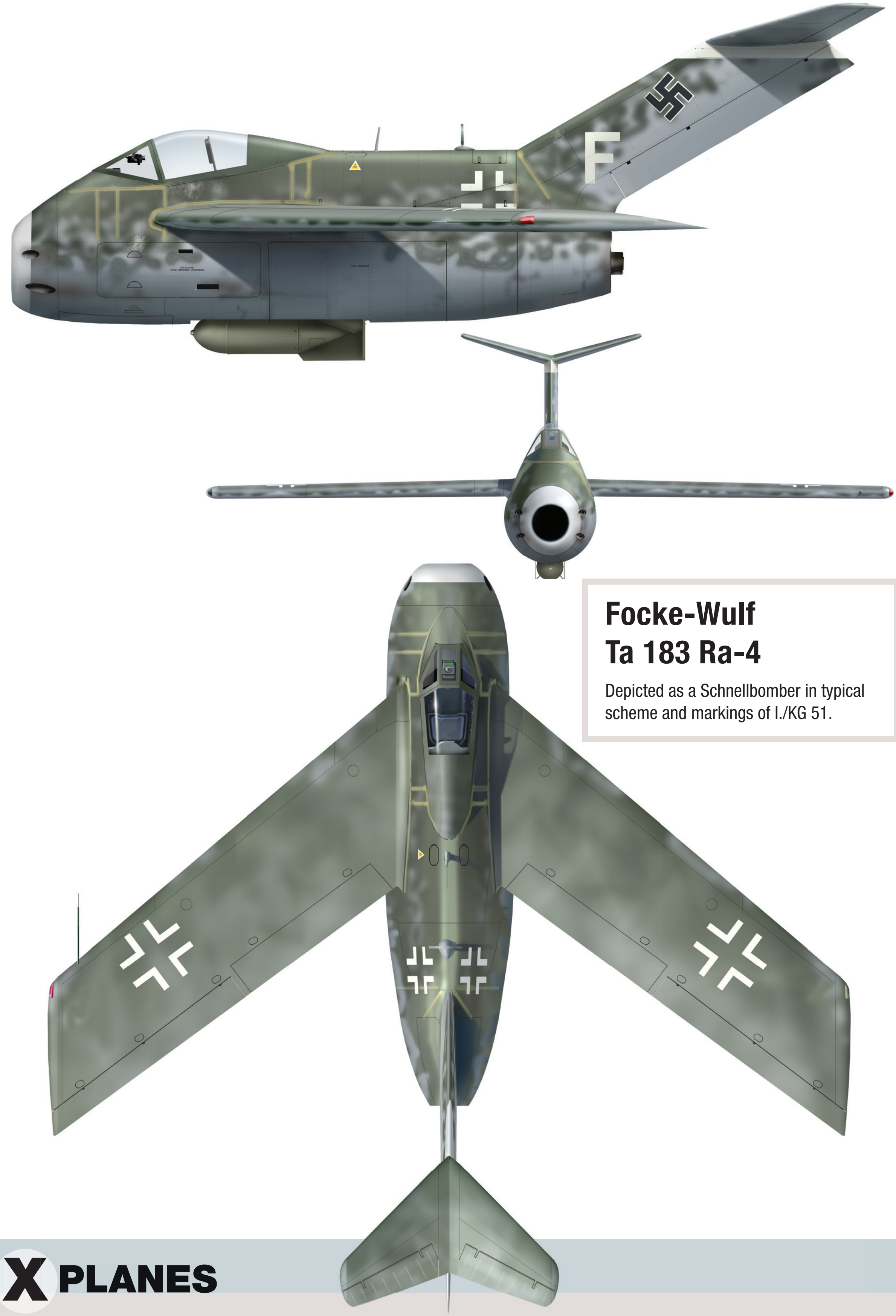
Finally, on 10 January 1945, a small quantity of Jumo 004 engines was made available to Focke-Wulf for the Ta 183. With this development, Focke-Wulf was able to progress with advanced design work on the first three prototype aircraft, basing the specifications on the Ra-2 to Ra-4 variants. Thus, the Ta 183 V1 was to be fitted with a Jumo 004, while the Ta 183 V2 and V3 would have the much anticipated HeS 011A-0 pre-production engine.

ABOVE LEFT Watched by Kurt Tank (in short-sleeved shirt), Ing. Ulrich Stampa, a specialist in wood, metal and hydraulics, prepares to hand-launch his model of a Ta 183 in the grounds of the Focke-Wulf facility at Bad Eilsen.

ABOVE The sweep-back of the Ta 183's wing can clearly be seen in Ulrich Stampa's model. To the right of Stampa is Oberingenieur Ludwig Mittelhüber, who worked on the designs of the Focke-Wulf jet projects, but who remained unconvinced of the practicality of assessing the aircraft by the use of models, while to the far right is Tank's planning assistant, Oberingenieur Willi Käther.


Rumpfhinterteil
Rumpfoberteil
Rumpfunterteil
Gesamtmontage für Ausrüstung und Elektrik in dem Rumpfschalen möglich
30.10.44
TL-Jäger
Rumpf

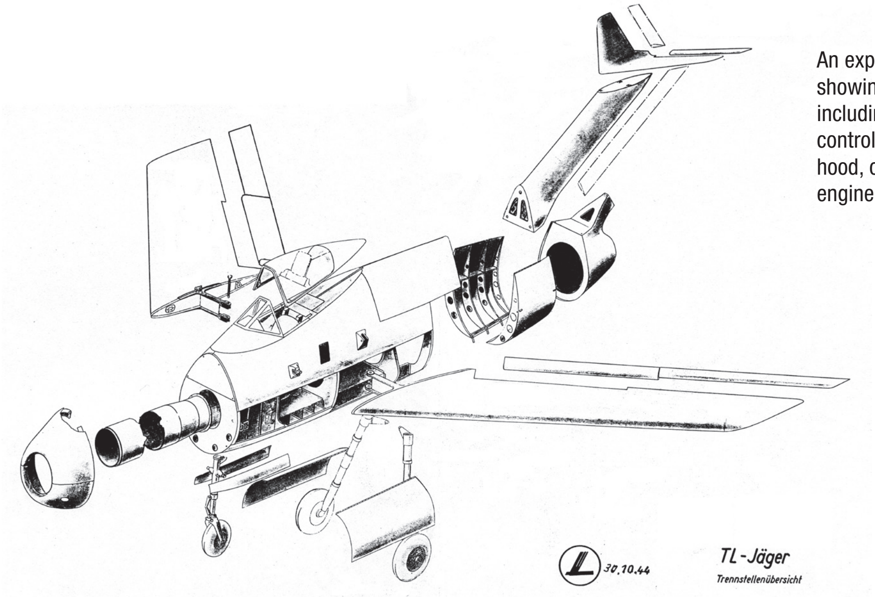
A selection of views showing the internal build of the rear, central and underside sections of the fuselage of the Ta 183.



Focke-Wulf Ta 183 Ra-4

Depicted as a Schnellbomber in typical scheme and markings of I./KG 51.

FOCKE-WULF Ta 183 Ra-4

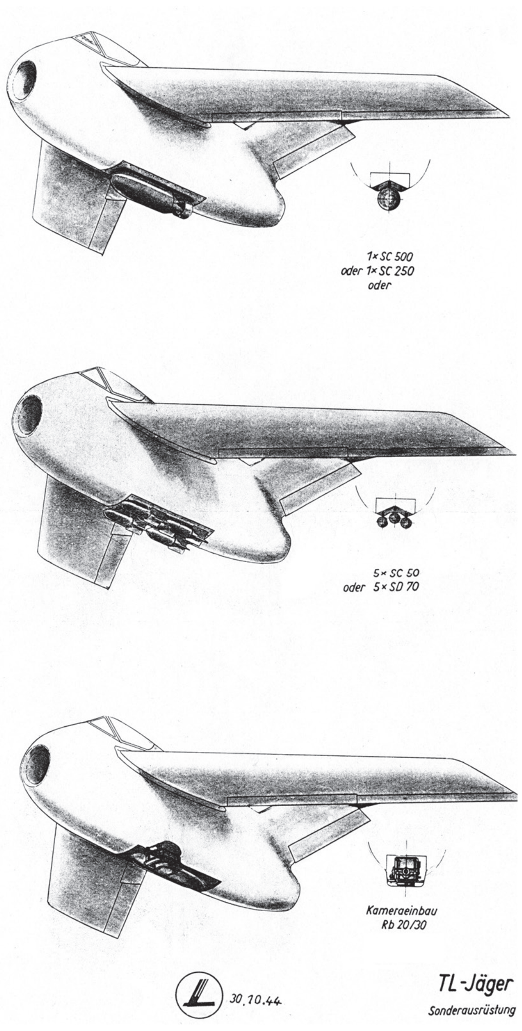


An exploded view of the Ta 183 showing the main component parts including the wing fitment bolts and control surfaces, intake duct, canopy hood, oleo legs, wheel doors, gun bay, engine vent tube and tail assembly.

Provision was also made for the fitment of an auxiliary rocket-boost motor, probably of either Walter or BMW manufacture, to the HeS 011 for increased climb performance when operating in the interceptor role. The pumps for the rocket-boost unit were driven by the HeS 011. According to a Focke-Wulf description, 'For operation of the TL-unit one half of the normal amount of fuel is carried. The "C-Stoff" [a mixture of hydrazine hydrate, methanol and water] and "T-Stoff" [an aqueous solution of concentrated hydrogen peroxide] are carried in two external, droppable tanks that are hung at unequal distances from the centre of the fuselage so that the normal position of the centre of gravity is preserved. The duration of thrust has been measured to 200 seconds. The volatile rocket fuel can, in this way, be stored in the tanks and makes it possible for ground personnel to rapidly ready the aircraft.'

At this time the armament was also reviewed so as to carry five MK 108s or two of those cannon and a pair of 30mm MK 213s. Additionally, a proposal was put forward to fit underwing launching racks for two batteries of 55mm R4M air-to-air rockets or to carry four Ruhrstahl X4 missiles.

It was also envisaged that the Ta 183 would operate as a high-speed bomber, carrying bomb loads of up to 500kg, to comprise either a single 500kg SC (general purpose) or SD (fragmentation) 500 bomb, or a BT (*Bombentorpedo*) 200 aerial torpedo. Ordnance would be stowed, as Tank had first proposed, in an open bay built into the lower fuselage.



Ulrich Stampa pushes his model of the Ta 183 into the air at Bad Eilsen. Looking on, second from left, is the Luftwaffe fighter ace Oberst Günther Lützow, *Kommodore* of JG 3 during the early part of the war and a recipient of the Knight's Cross with Oakleaves and Swords. The second German fighter pilot to be credited with 100 victories, at the time of this photograph Lützow was serving as commander of the 4. *Fliegerschuldivision* at Strassburg, where he was responsible for the training of new fighter pilots.

Focke-Wulf envisaged the Ta 183 V1 making its maiden flight in May or June 1945.

It was eventually decided that if the HeS 011 was further delayed, then the prototype *Huckebeins* would be fitted with Jumo 004s. Then, a week before the RLM conference to assess the emergency fighter proposals on 27/28 February 1945, Focke-Wulf drew up a production schedule which foresaw flight-testing of the pre-production aircraft some time before September 1945, with the first series production machine coming off the assembly line the following month, and the second in November. It was planned that seven more aircraft would follow that month, with a further twenty in December. Long term, Focke-Wulf's optimistic aim was to produce 300 Ta 183s per month by May 1946.

RUHRSTAHL X4 ROCKET

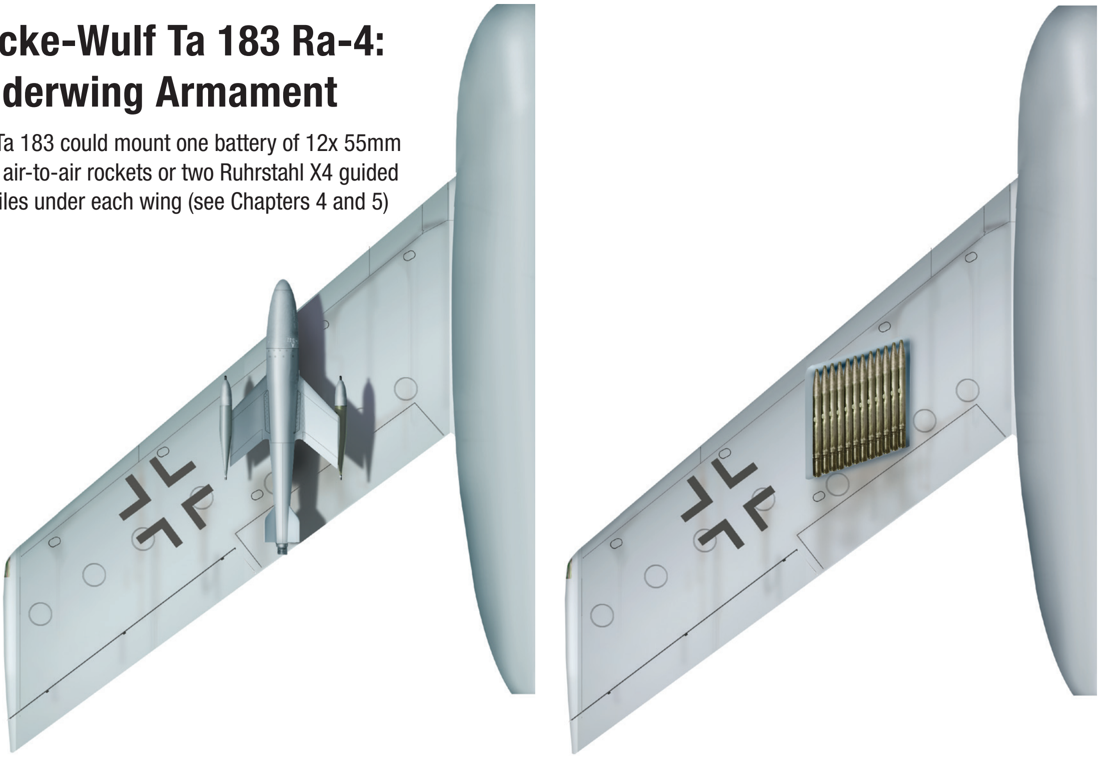
In December 1944, a committee headed by Generalmajor Walter Dornberger, the commander of the German Army's A4 rocket organisation, was set up to coordinate new anti-aircraft missile development for the defence of the Reich. The committee's main task was to cancel projects that were believed to duplicate others or which were too slow or complex, and to award contracts to those projects deemed to be workable and realistic.

One of the few projects falling into the latter category was the Ruhrstahl X4, a wire-controlled, rocket-propelled, fin-stabilised, air-to-air missile fitted with a proximity-fused warhead and intended for launching by fighters against formations of heavy bombers. Cigar-shaped, it had a 20kg warhead section that was made of steel, a central body cast in aluminium and a tail section of four pieces of thin aluminium sheeting welded together. The wings and tail were cruciform in appearance. The Dornberger Committee felt that the weapon offered sufficient promise to merit further development and

OPPOSITE A Focke-Wulf sketch showing planned Sonderausrüstung (special fittings) for the Ta 183's open fuselage carriage bay, with, at top, for the fighter-bomber role, option for one SC 500 bomb or one SC 250, while, at centre, five SC 50 or SD 70 bombs and, at bottom, installation of an Rb 20/30 camera for reconnaissance.

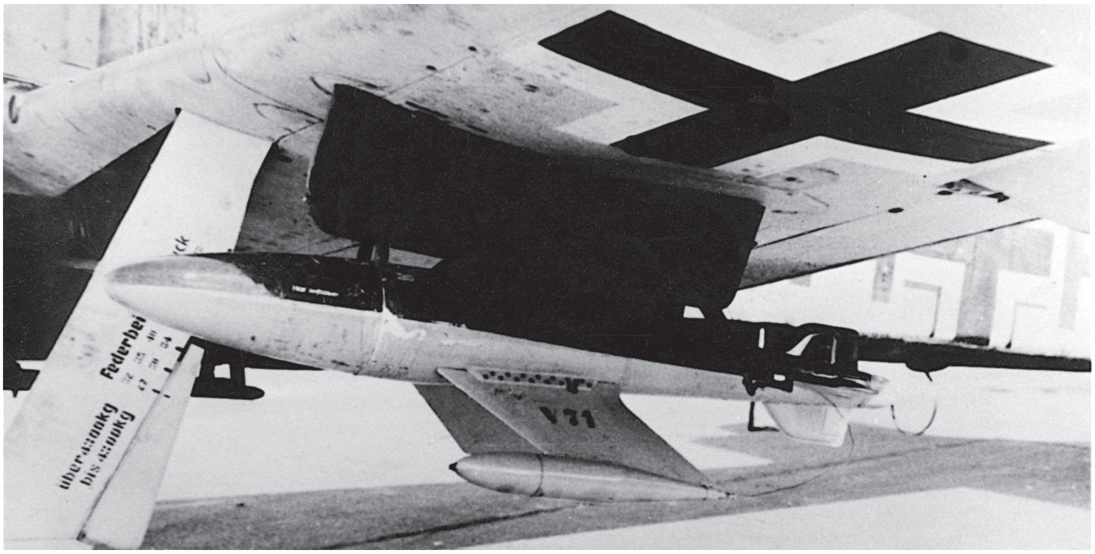
Focke-Wulf Ta 183 Ra-4: Underwing Armament

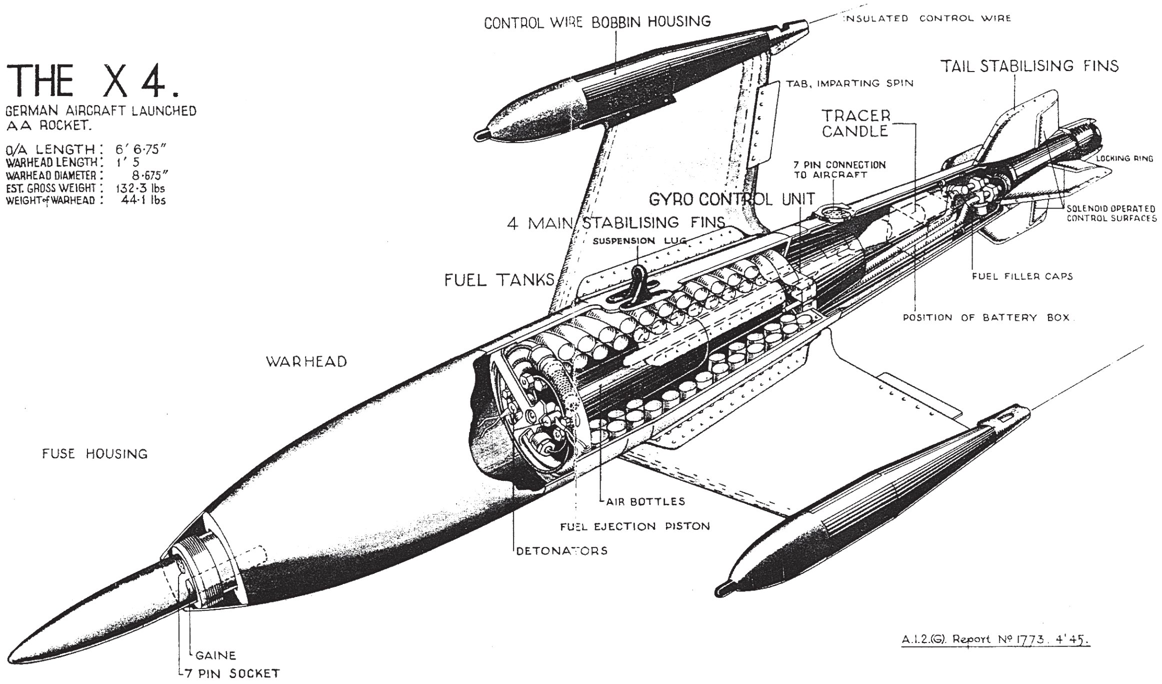
The Ta 183 could mount one battery of 12x 55mm R4M air-to-air rockets or two Ruhrstahl X4 guided missiles under each wing (see Chapters 4 and 5)



was planned, initially, for carriage on the Fw 190 and Me 262, usually in batteries of four missiles per aircraft.

Originally conceived in June 1943 by Dr Max Kramer, a scientist and aerodynamicist who was employed by Ruhrstahl, and inspired by his SD 1400 'Fritz X' guided anti-ship glide bomb, the X4 was manufactured by the Ruhrstahl AG Presswerke at Brackwede and Brinkmann & Co in nearby Hövelhof.




THE X4.
GERMAN AIRCRAFT LAUNCHED AA ROCKET.
O/A LENGTH : 6′ 6·75″
WARHEAD LENGTH : 1′ 5
WARHEAD DIAMETER : 8·675″
EST. GROSS WEIGHT : 132·3 lbs
WEIGHT of WARHEAD : 44·1 lbs
CONTROL WIRE BOBBIN HOUSING
INSULATED CONTROL WIRE
TAIL STABILISING FINS
TAB, IMPARTING SPIN
TRACER CANDLE
7 PIN CONNECTION TO AIRCRAFT
LOCKING RING
GYRO CONTROL UNIT
SOLENOID OPERATED CONTROL SURFACES
4 MAIN STABILISING FINS
SUSPENSION LUG
FUEL TANKS
FUEL FILLER CAPS
POSITION OF BATTERY BOX
WARHEAD
FUSE HOUSING
AIR BOTTLES
FUEL EJECTION PISTON
DETONATORS
GAINE
7 PIN SOCKET
A.I.2.(G). Report Nº 1773. 4'45.

A cutaway drawing produced by British Air Technical Intelligence in April 1945 of the Ruhrstahl X4 air-to-air rocket, which was planned for use with the Ta 183 and the Messerschmitt P.1101.

The X4 was to be fitted to an underwing or under-fuselage 70kg ETC 70 A1 or ETC 71 C1 launch rack. Once fired, ideally from a range of 1.5–2.5km, the weapon was controlled using the pilot's visual observation, operating it in conjunction with signalled corrections using the FuG 510 Düsseldorf transmitter and FuG 238 Detmold receiver from a small control unit in the aircraft that was connected to the missile's flying surfaces by two insulated wires. The pilot would move the control unit's single stick fore and aft for elevation correction and side-to-side for azimuth correction. Separate switches were used for pre-selection of any one of the four missiles carried and for starting the stabilising gyro prior to launching. The pilot would aim at the target using a reflector sight, pressing the release button that disengaged the gyro, fired the piercing detonators, armed the fuses, functioned the fin-tip tracer candles and released the missile all in the same instant.

Shortly after release, the X4 would reach a speed of some 250m/sec. Propulsion came from a bi-fuel BMW 548 rocket motor developed by Dr-Ing. Helmut Zborowski, which functioned from the reaction between S-Stoff (or *Salbei* – 'sage'), a nitric acid oxidant formed of 96 per cent nitric acid HNO3 and 4 per cent ferric chloride FeCl2, and Tonka 250 rocket fuel – a composition of 57 per cent crude oxide monoxylidene with 43 per cent triethylamine. The motor was capable of delivering an initial thrust of 125–145kg, which fell progressively to 20–30kg after 30 seconds.

Stabilisation in flight was achieved by means of four large swept wings fitted to the fuselage of the weapon, and four small fins, the latter incorporating solenoid-operated control surfaces through which two-dimensional directional control was achieved. The four wings each had a small, aluminium trimming tab fitted at the trailing edge that

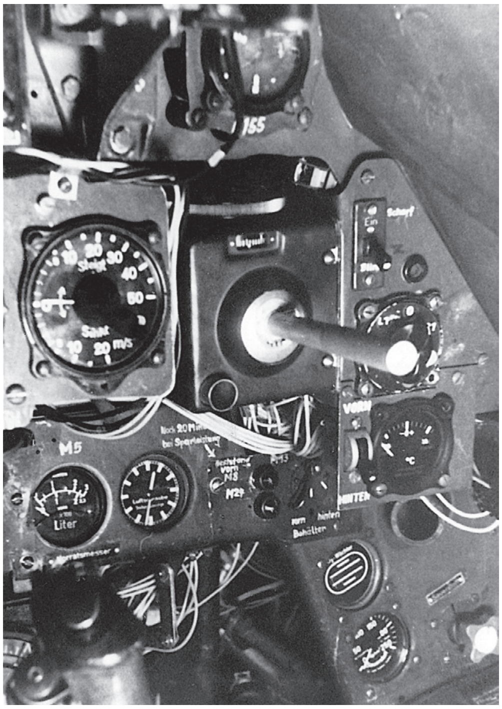
LEFT A Ruhrstahl X4 rocket is suspended from an ETC 71 C1 launch rack fitted to the underside of an Fw 190 during trials at the Luftwaffe *Erprobungsstelle* at Karlshagen in late 1944. The wire-guided weapon was slated for use on the Ta 183 and other Luftwaffe jet fighter projects.

caused the missile to spin about its horizontal axis at a rate of one rotation per second during flight.

Two of the diametrically opposite wings were fitted with torpedo-shaped housings, each containing a spool wound with approximately 6km of 0.2mm-diameter insulated steel wire, to the ends of which were fitted plugs for connection into the aircraft control apparatus. The other two wings were fitted with tracer candles at their tips. After launch, a pyrotechnic train in the Rheinmetall Kranich fuse was initiated electrically. Seven seconds later the proximity and impact elements were armed. If, after 28 seconds, the missile failed to find a target, the train initiated a self-destruct element.

The first air-launched tests with the X4 were conducted in September 1944 at the Luftwaffe *Versuchsstelle* at Peenemünde-West using an Fw 190 as a carrier aircraft and were considered partially successful, but weapons specialists always remained somewhat hesitant over the X4's deployment in numbers because of the volatility of its fuel system. Furthermore, it was thought that vulnerability of the parent aircraft to fighter attack would restrict the effective use of the missile in a combat situation. Development is believed to have been officially terminated on 6 February 1945, although air tests continued through that month using Ju 88s. Test-flights were also undertaken by an Me 262 jet fighter with two X4s under the wings outboard of the jet nacelle, but they were not launched.

Some 100–200 missiles are believed to have been completed, but many of the intended BMW 548 rocket motors were destroyed in air attacks on the company's works at Stargard.



The guidance control stick for the Ruhrstahl X4 built in to the instrument panel of an Fw 190 fighter for tests at the *Erprobungsstelle* at Karlshagen. The pilot launched the rocket by using a release switch on top of the main control column. He was also provided with an elbow rest on the starboard side of the cockpit to enable more comfortable operation.

SPECIFICATIONS	
Overall length	200cm
Length of warhead	45cm
Diameter of warhead at base	22cm
All-up weight of missile before launch	60kg
Weight of warhead	30kg
Approximate fuel tank capacity	
Salbei	4–5 litres
Tonka	2 litres
Maximum launching range	2,835m
Glide ratio	1:5 to 1:6
Duration	30 seconds
Maximum acceleration	3g
Maximum speed	805km/h at 6,400m

CHAPTER SIX

HEINKEL P.1078C

Dr Ernst Heinkel (right) sketches in a pencil adjustment to a plan of the He 111 on the drawing board in July 1941, watched by Siegfried Günter. The latter would go on to become EHAG's Senior Design Engineer, a capacity in which he produced the P.1078 project as a contender for the RLM's emergency fighter programme in December 1944. Not long before he had been instrumental in the design of the He 162 *Volksjäger*.

Ernst Heinkel turned, as usual, to his Senior Design Engineer, Dipl.-Ing. Siegfried Günter, for a design to conform to Knemeyer's Emergency Fighter Competition at the end of 1944. Based at the Ernst Heinkel AG (EHAG) *Entwurfsbüro* (Project Office) in the Vienna district of Schwechat, Günter was reputed to be 'one of the inventive brains of the Heinkel concern'. At the time of Knemeyer's request, EHAG had experienced bittersweet success with the first flights of the He 162, the small jet interceptor with which the company had won the tender of September 1944 to build a '*Volksjäger*', a cheap, quick-to-build interceptor powered by a single engine and able to be flown, if necessary, by young, hurriedly trained pilots from primitive airfields on missions in defence of the Reich.

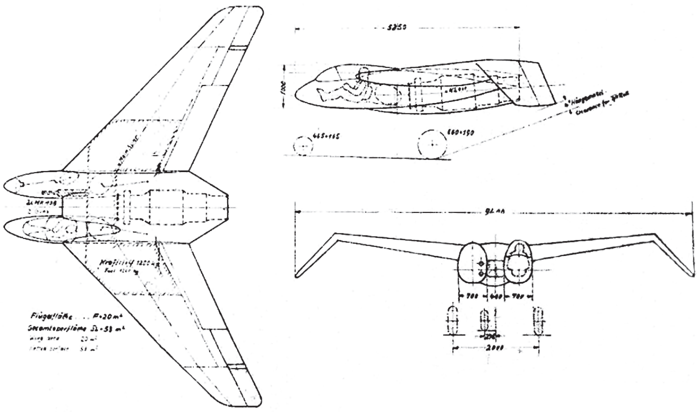
Günter had joined EHAG in 1931 along with his twin brother, Walter. With the unassuming manner of a country school teacher, Siegfried was the mathematician of the pair, while Walter was more artistic, with a true flare for design. As boys, they had built gliders, and later as young engineers, they had designed powered gliders and fast sports aeroplanes. Whilst they loved speed, from an early stage, Ernst Heinkel also recognised that the Günter brothers 'could design the aerodynamic shapes I was looking for'. Indeed, the twins went on to design some of the most important and famous aircraft associated with Heinkel, including the He 51, He 70, He 111 and He 177.

It is not clear as to precisely when Siegfried Günter first commenced work on what became the P.1078, but in December 1944 he submitted three versions of the project for consideration as an emergency jet fighter by the RLM. The P.1078A mounted a single HeS 011 engine in its lower fuselage, while the gull wings were swept back 40 degrees and a nosewheel was built in slightly to the right of the forward fuselage ahead of the cockpit. It was a design not unlike Messerschmitt's P.1101 (see Chapter 8).

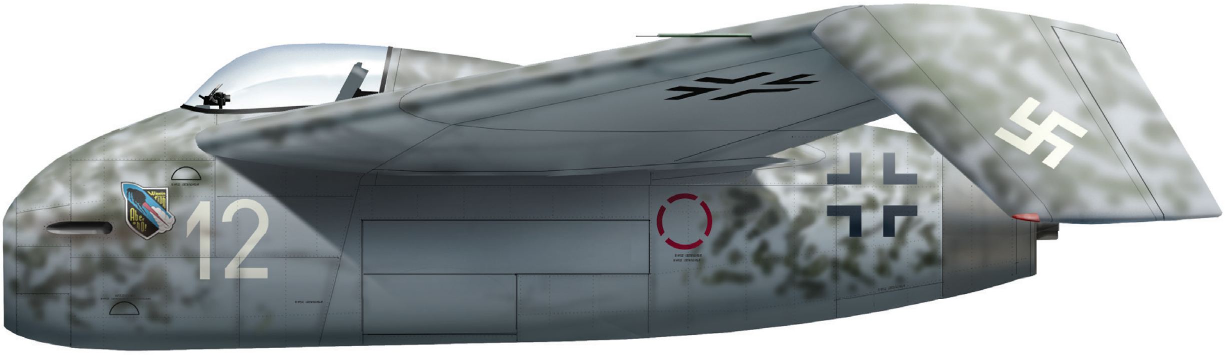
The P.1078B was an entirely different, tailless design featuring a short, 6m fuselage, the forward part of which, unusually, was formed of two pods. The one to the left accommodated the pilot, while the one to the right contained the bay into which the nosewheel retracted, and also carried the armament of two 30mm MK 108 cannon, for which EHAG designed an automatic triggering system. Again, the wings, with a span of 9.2m, were swept back to 40 degrees, but their tips had a distinctive anhedral.

The B version did have superior performance to the A, but the RLM and DVL felt that the flatter, rectangular air intake, which was set back deep between the fuselage pods, might introduce problems in the aircraft's general functioning, aside from the fact that the pilot's view to the right was restricted by the adjacent pod.

But it was the P.1078C, which bore some resemblance to the Blohm & Voss BV P.212.03, that became the RLM's choice from the Heinkel selection. This version was an all-wing fighter, powered by a single HeS 011 engine installed in the rear fuselage, with a span of 9m and a length of just 6.10m, and was to be built from a metal fuselage mated to a 40-degree swept-back, wooden wing that was to carry the entire fuel load of 1,450 litres. Like the B, the air intake duct of the C version was to have been of a flatter, rectangular design to allow space for the cockpit and the retracted nosewheel. The mainwheels were to have retracted forwards and sideways into bays in the fuselage while rotating through an angle of 180 degrees about the oleo axis, but the small size of the fuselage meant they would protrude slightly when raised. As with the B, the wingtips of the P.1078C also had marked anhedral, and were intended to replace a rudder and the horizontal stabiliser, Günter being of the opinion that they would have less of an influence on the critical Mach number of the wing than vertical fins and also offer better roll damping. Günter also projected that this aircraft would outperform his A design in terms of altitude and speed at sea level, as well as being some 150kg lighter.

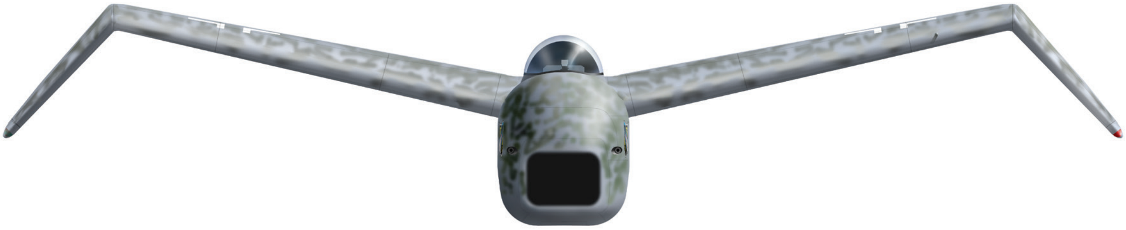


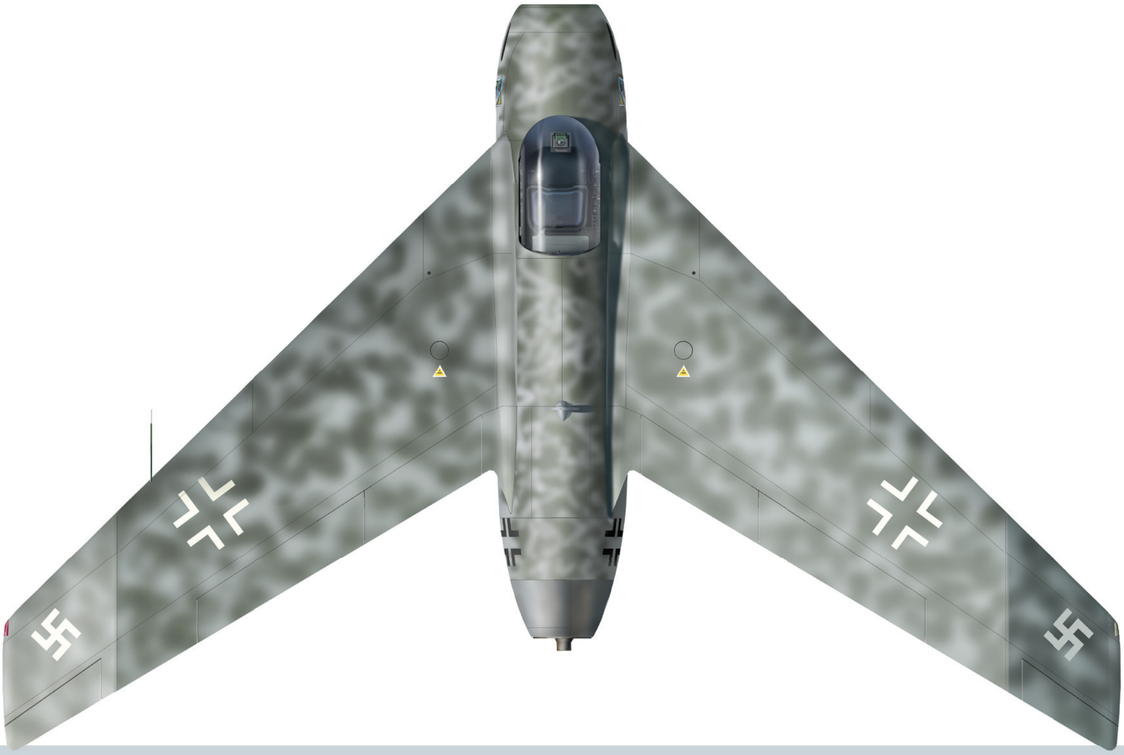
A plan of Heinkel's P.1078B emergency fighter proposal of late 1944, showing an unusual two-pod layout, with 40-degree swept-back wings and tips with anhedral. The plan, which appears to have been produced for the Allies in August 1945, also shows the installation of two 30mm MK 108 cannon and an HeS 011 turbojet. However, it was the P.1078C which the RLM selected as EHAG's contender for the emergency fighter 'competition'.

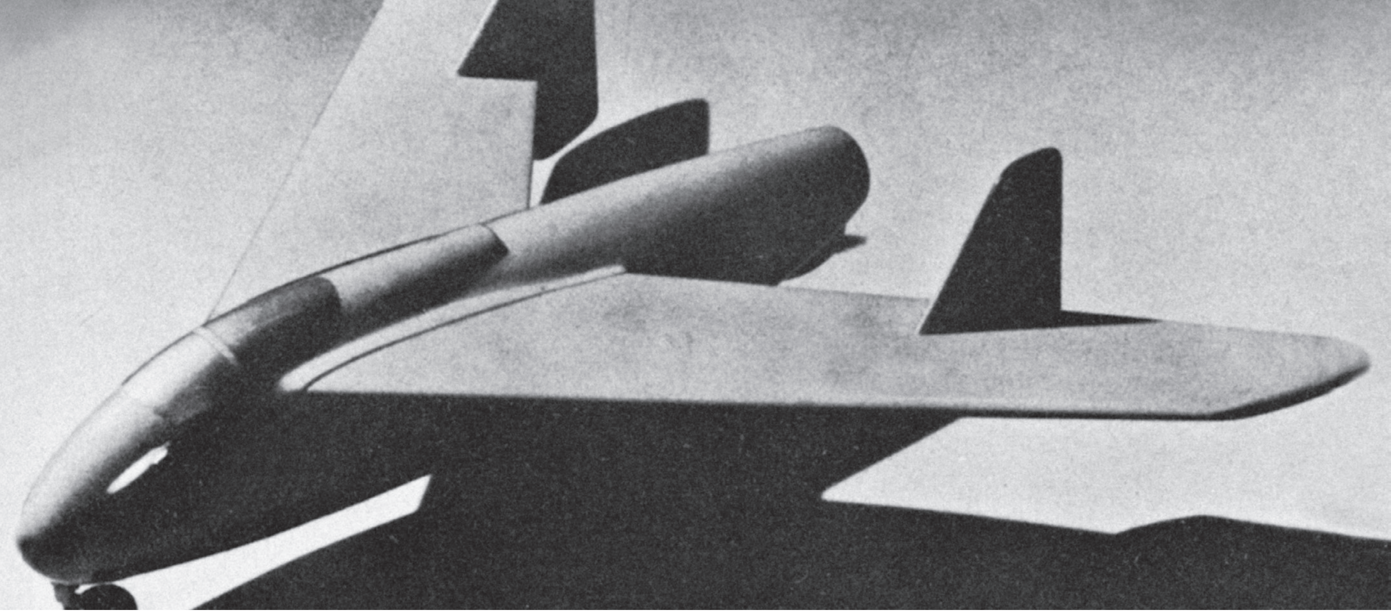


Heinkel He 1078C

Depicted as an aircraft of I./JG 400 in a typical scheme of that *Geschwader*, with 1.*Staffel*'s 'Like a flea, but oho!' emblem.







CHAPTER SEVEN

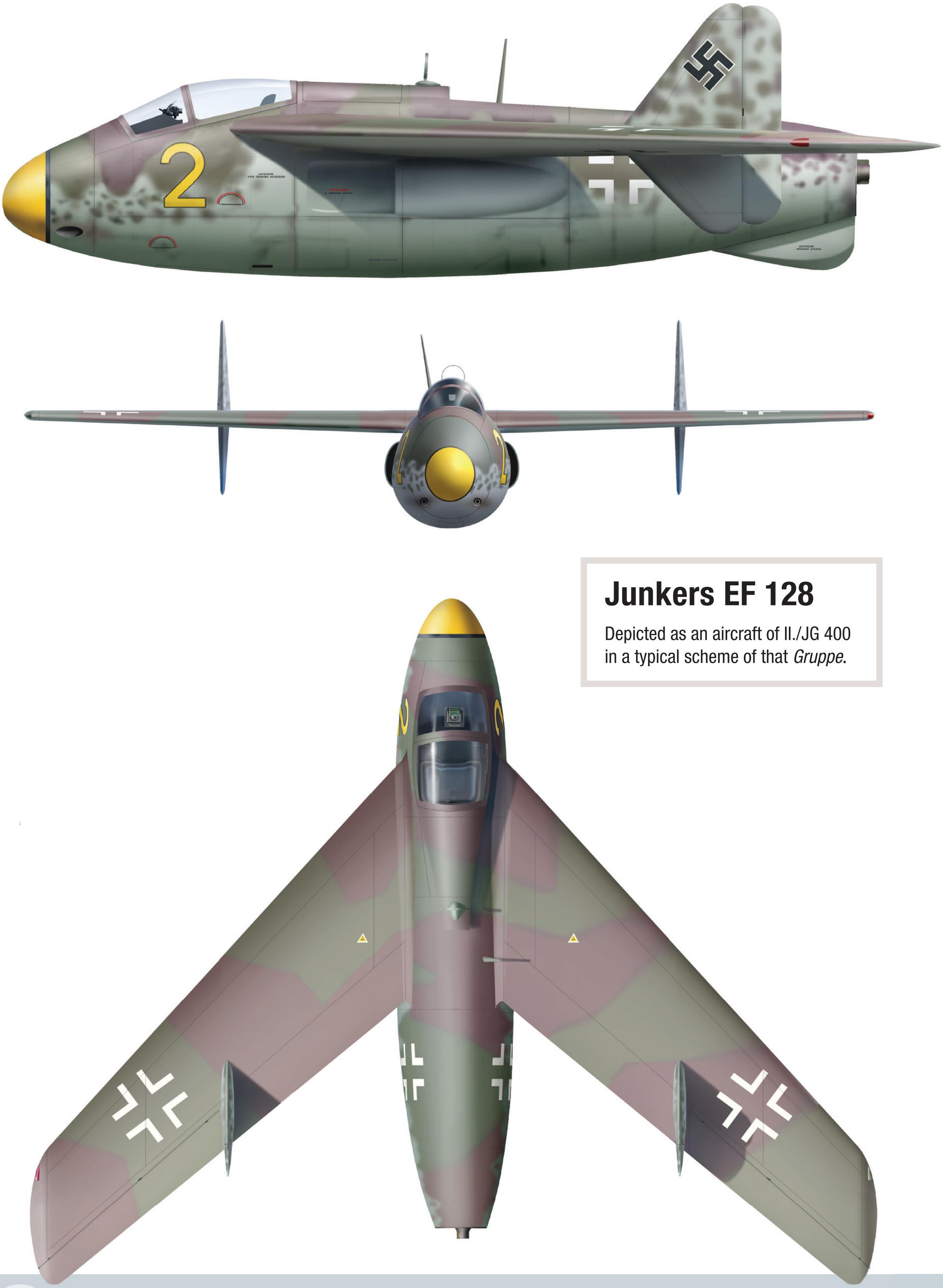
JUNKERS EF 128

A perspective view of a model of the Junkers jet-fighter project, the EF 128. The design was recognisable by its vertical fins fitted to the trailing edge of each shoulder-mounted wing. Another small, ventral fin was located just below the engine vent at the rear of the aircraft.

The Junkers Flugzeugwerke's December 1944 submission for the Emergency Fighter Programme arrived in the shape of the EF (Entwicklungs Flugzeug – Development Aircraft) 128, a tailless fighter design originating from the previous October. Design and development of the project had been overseen by Junkers' very experienced Technical and Development Director, Prof. Dr-Ing. Heinrich Hertel. Hertel had worked at the DVL at Berlin-Adlershof as a test engineer and in 1930 received his doctorate from the *Technische Hochschule* in Berlin-Charlottenberg, his thesis centring on 'torsional rigidity and torsional strength in aircraft components'. He worked for Heinkel at Rostock from 1933, being appointed Technical Director a year later, but after a dispute with Ernst Heinkel he left to join Junkers in 1939.

Hertel was assisted on the EF 128 project by Dipl.-Ing. Hans Gropler, a Junkers veteran and head of the *Kontruktionsbüro-Entwurf* (Project Office), and Dr Georg Backhaus from the *Abteilung Strömungstechnik* (Aerodynamics Department), who had worked on the forward-swept wings of the experimental, multi-engine Ju 287 jet bomber.

As with the Blohm & Voss, Heinkel and Henschel proposals, the design incorporated a wooden, two-spar, shoulder wing, swept-back to 45 degrees at the quarter-chord position, joined to the midpoint of a short, all-metal fuselage that was 8.3m in length. The span was 9.2m. A vertical fin was fitted to the trailing edge of each wing, inboard of the ailerons, with another small, ventral fin located just below the tailpipe at the aft end of the aircraft. Control surfaces were made up of elevators and ailerons on the wings, as well as twin rudders and



Junkers EF 128

Depicted as an aircraft of II./JG 400 in a typical scheme of that *Gruppe*.

X PLANES

JUNKERS EF 128

automatic leading edge slots. The lateral control surfaces were above and below the wing at the beginning of the ailerons.

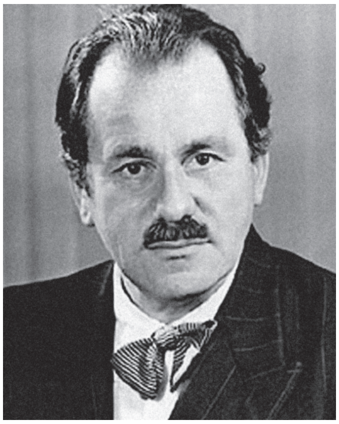
An HeS 011 engine was enclosed in the rear of the fuselage and was accessible through removable parts of the outer shell of the fuselage. Air intakes for the HeS 011 engine were positioned on each side of the fuselage beneath the wings and were designed to divert the boundary layer air flow to a vent just aft of the cockpit canopy. Access to the engine was facilitated by large, removable panels. The main landing gear (710x185mm) was narrow track and fitted with pneumatic shock absorbers. The nosewheel (465x165mm) retracted rearwards into the fuselage.

The pilot was accommodated in a pressurised cockpit that was located at the front of the aircraft and which was fitted with an ejection seat and a fire extinguisher. Armour plate was installed that was intended to offer protection from 12.7mm rounds from the front and 20mm rounds from the rear. Armament comprised a single 30mm MK 108 (100rpg) or 20mm MG 151/20 cannon installed in each side of the nose area, with provision for a further two such weapons if needed.

A total of 1,025 litres of fuel was carried in two protected fuselage tanks located behind the cockpit, with a further 540 litres stored in unprotected inner wing tanks. The total takeoff weight of the aircraft was projected as 4,900kg, with a range of approximately 1,800km. The EF 128 also featured air brakes located at the rear end of the fuselage and a brake parachute to be used when landing, an especially useful asset on smaller, forward airfields.

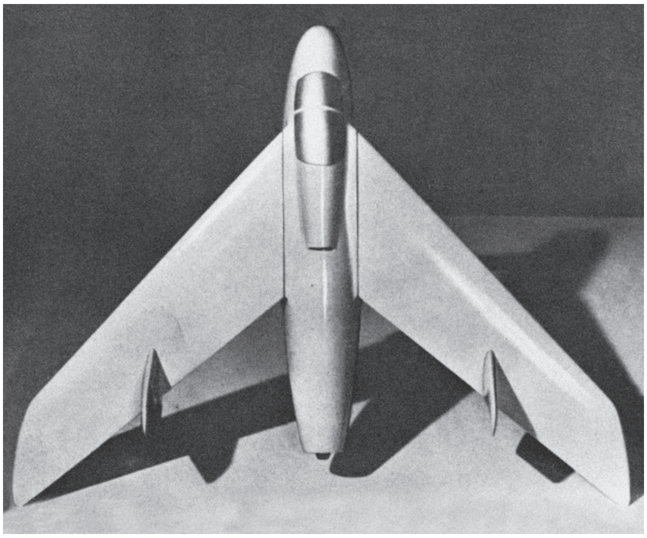
Junkers completed a wind tunnel model of the EF 128, and despite some initial concerns over stability, tests at the company's plant at Dessau proved sufficiently encouraging to prompt the construction of a wooden mock-up fuselage fitted with an HeS 011. This was intended for air-testing and was to be fitted above a Ju 88A-4 carrier aircraft. Testing on models continued until late April 1945, but the results of further modifications to the wings and fuselage were inconclusive.

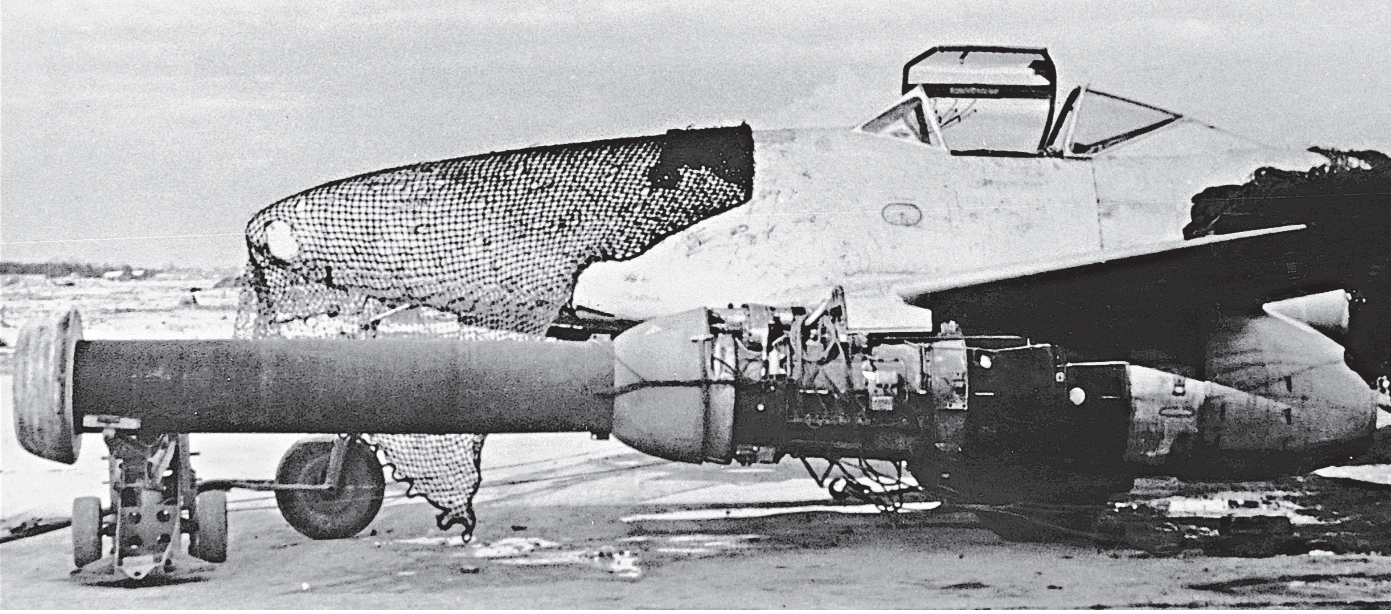
In the final weeks of the war, Junkers' designers drew up plans for an all-weather fighter, nightfighter or bomber version of the EF 128, featuring a lengthened fuselage that could accommodate a second crew member and associated radar and radio equipment, and/or a bombload. Series production was planned for mid-1945, but development had to be abandoned with the end of the war.



Professor Dr-Ing. Heinrich Hertel had once worked for Heinkel in Rostock, where he was involved in the development of the He 100 and He 111, but following a disagreement with Ernst Heinkel he became Junkers' Technical and Development Director at Dessau, where he worked on many projects including the EF 128.

This view of the model EF 128 illustrates the 45-degree sweep-back of the wings and the scale of the aircraft in relation to its single-seat cockpit. Hertel intended that the fighter be used for ultra-short intercept missions against enemy bomber formations in the defence of important factories and facilities. Maximum endurance was to be 11 minutes.





CHAPTER EIGHT

MESSERSCHMITT P.1101

Me 262A-1 Wk-Nr. 130015 was an early production aircraft that was re-designated as the second Me 262 V1. During the second half of 1944 it was used for various equipment, pressurisation, armament and rudder tests. It was also fitted with a range of experimental ducts to the front of its port side Jumo 004 engine in order to measure thrust loss associated with the Messerschmitt P.1101.

From early 1944, once advanced development of the Me 262 was in progress and construction of prototypes underway, designers at Messerschmitt's project office at Oberammergau in southern Bavaria, some 70km south of the firm's main plant at Augsburg, commenced work on new jet fighter designs that would keep them, perhaps deliberately, occupied for most of the final months of the war.

It had been on 5 January 1944, following an internal company meeting, that a quite revelatory memo was drafted summarising Professor Willy Messerschmitt's design theories for an advanced, jet-engined fighter in which the engines were enclosed in the fuselage:

'As it is fundamentally recognised that housing the engines within the fuselage is better from a drag standpoint, Professor Messerschmitt proposes constructing an ultra-high-speed aircraft as a testbed for evaluating the current information with regard to increasing the critical Mach number. The fuselage of this aircraft is to be enlarged enough so that the engines can be installed side-by-side, one above the other, or in tandem, and be able to accommodate a wing with approximately 35-degree sweep-back.

'Studies are also in preparation to address the matter of engine air intake and exhausts. As the results of these will also be expected to take several months, Professor Messerschmitt suggests locating the intake at the fuselage's aerodynamic stagnation point, with the exhaust opening as close to the tail as possible, as this would most likely be the configuration involving the least amount of risk. Intake flow loss and potential exhaust flow loss can be clarified on paper.'

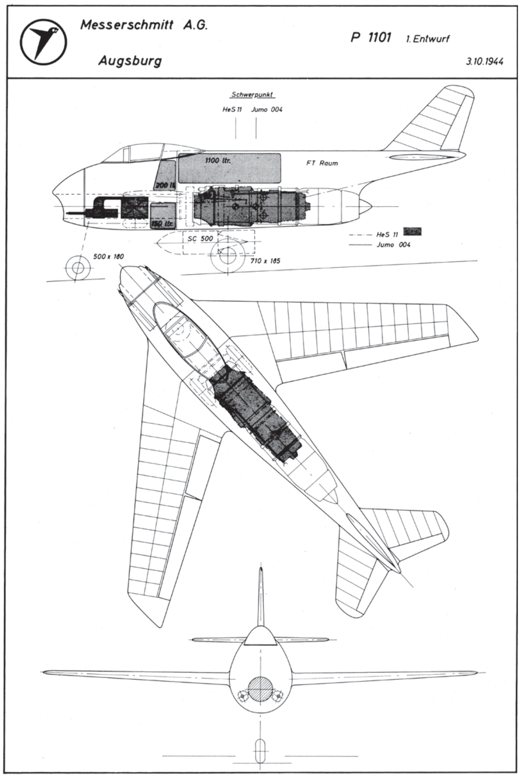
Professor Willy Messerschmitt, at far right, discusses a drawing with Rakan Kokothaki (left, sitting) and Heinrich Hentzen, both of whom would serve as plant managers for the company. As early as January 1944, Messerschmitt discussed with his colleagues his thoughts for an advanced, jet-engined fighter in which the engines were enclosed in the fuselage. These led to the P.1101.

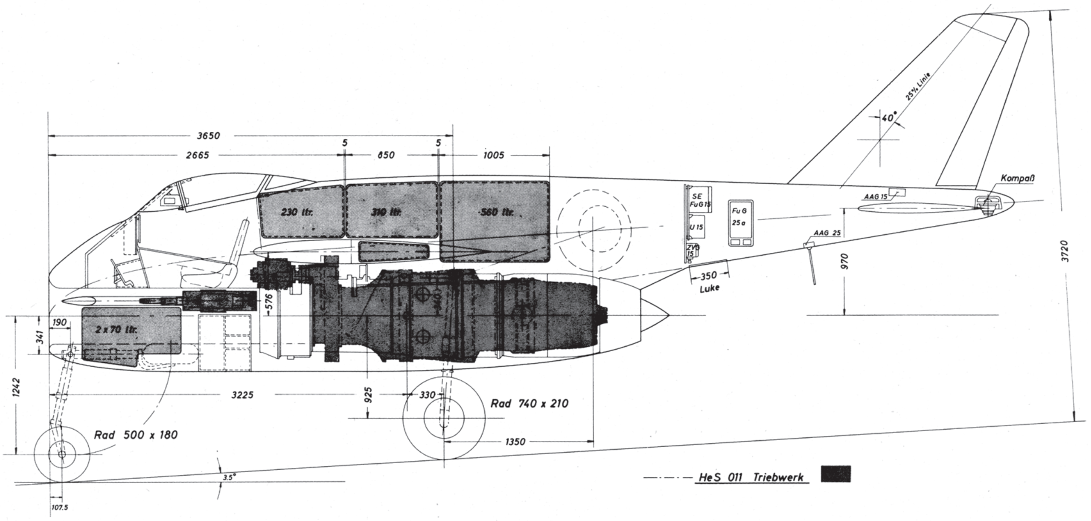
Over time, Messerschmitt's *Hochschwindigkeit* (HG – high-performance) designs would involve several widely different variants, including swept-back and swept-forward wings, multi-jet engine, piston engine, VTO and rotor projects, but many became known as sub-variants under the blanket designation P.1101. To a great extent, these would reflect Professor Messerschmitt's principle of mating the smallest possible airframe with the most powerful engine in order to attain maximum performance, along with the use of, if possible, state-of-the-art construction and incorporation of the latest aerodynamic research. Indeed, such was Messerschmitt's faith in one of these designs that he put it forward as his company's entry for the Emergency Fighter Competition, although from the outset, the company's designers had seen the aircraft also being used as an all-weather fighter, nightfighter and reconnaissance aircraft. It was described by the company as being 'the smallest turbojet fighter with minimal costs and maximum performance using an HeS 011 engine'. It was given the designation P.1101.

Much of the early work had been overseen by the Director of Messerschmitt's *Vorprojektbüro* (Preliminary Projects Department), Dipl.-Ing. Hans Hornung, along with company veteran Dipl.-Ing. Woldemar Voigt, head of the *Projektbüro*, and Dipl.-Ing. Riclef Schomerus, head of aerodynamics in the projects office.

Hornung's preliminary design, known as the P.1101 XVIII/113 from 30 August 1944, showed a solid nose, similar in shape to that of the Me 262 and using that type's outer wing sections, with the intakes for an HeS 011 engine built into the wing roots of the sharply swept-back wings along with a butterfly tail. The engine was to be installed in the fuselage and there was to be a 'limitation' on armament and fuel load, with the aim of keeping the total weight down. Wherever possible, and especially in terms of wing assembly, undercarriage and controls, the design was to use components already available in order to save time. However, this was later revised during the autumn of 1944 to incorporate a simpler nose intake and duct with the exhaust venting out beneath the tail boom. On 15 October Willy Messerschmitt produced an initial sketch showing what he termed an 'Experimental Aircraft' along these lines.

Tests were carried out in November 1944 using an early production Me 262A-1a, to which had been fitted various experimental intake ducts on its port





A more detailed profile of the P.1101 dated 13 November 1944. The option for a Jumo 004 remains, but the fuselage fuel load has been reduced to 1,240 litres. The mainwheels are shown as retracting to the rear, behind the aft fuel tank. The pilot has been supplied with an EZ 42 gunsight, with radio equipment comprising FuG 15 transceiver and FuG 25a Erstling IFF. The compass has been installed in the extreme tail section of the aircraft.

OPPOSITE A Messerschmitt three-view plan of the P.1101 from 3 October 1944. The aircraft is fitted with three fuselage fuel tanks with a total capacity of 1,450 litres and two MK 108 cannon in the nose, either side of the intake duct. Although an HeS 011 is shown as installed, the option to accommodate a Jumo 004 engine is also outlined. Radio equipment is fitted aft of the main fuel tank and external load consists of a 500kg SC 500 bomb.

side Jumo 004 turbojet, in order to assess the loss of thrust to a P.1101 design in relation to the length of the air duct used. Trials showed that a 3m-long duct reduced thrust by some 135kg.

In a revision of December 1944 the P.1101 showed a short forward fuselage with an oval cross-section, aft of which was a slender tail boom extending above and beyond the tail pipe. The aircraft was to be powered by a single HeS 011 turbojet, which was installed to the lower rear of the forward fuselage. The pressurised cockpit was located close to the nose and benefited from an all-round vision bubble canopy. The pilot was protected by armour plate able to withstand 12.7mm ammunition from ahead and from 20mm rounds fired from behind, and a FuG 16 radio set was to be installed (based on that of the Me 262). A nosewheel fitted to a single strut and an angled fork retracted with a 90-degree turn into the cavity beneath the air intake, while the mainwheels, using mainly Bf 109K components and fitted with Bf 109 shock absorbers, retracted inwards and to the rear.

Perhaps the most innovative aspect of the P.1101 was its wings, which were shoulder-mounted and adjustable while on the ground to a range of between 35 and 45 degrees' sweepback – something the Messerschmitt designers had been considering for several months. The wings had steel spars with wooden ribs and skinning. Control was applied using ailerons, elevators and the rudder, as well as wing leading edge slots and plain, camber-changing flaps.

Fuel was contained in three fuselage tanks installed behind the cockpit above the wing spars, with a maximum capacity of 1,565 litres.

The P.1101 could be armed with two or four 30mm MK 108 cannon and a single SC 500 bomb could be carried, but it was intended that the aircraft would be fitted with 55mm R4M air-to-air rockets or X4 guided rockets under the wings if they were available. Much of the weapons assessment and testing became the responsibility of Walter Keidel, who oversaw matters concerning the P.1101 in Messerschmitt's Production Liaison Office, and Paul Barmayer, who had worked on Me 262 cockpit pressurisation.

On 10 November 1944, the P.1011 project was handed over to the *Konstruktionsbüro* (Kobü) under Ing. Walter Rethel, who was briefed to use as many components from the Me 262 production lines as possible. An internal Messerschmitt memo of that date made things clear:

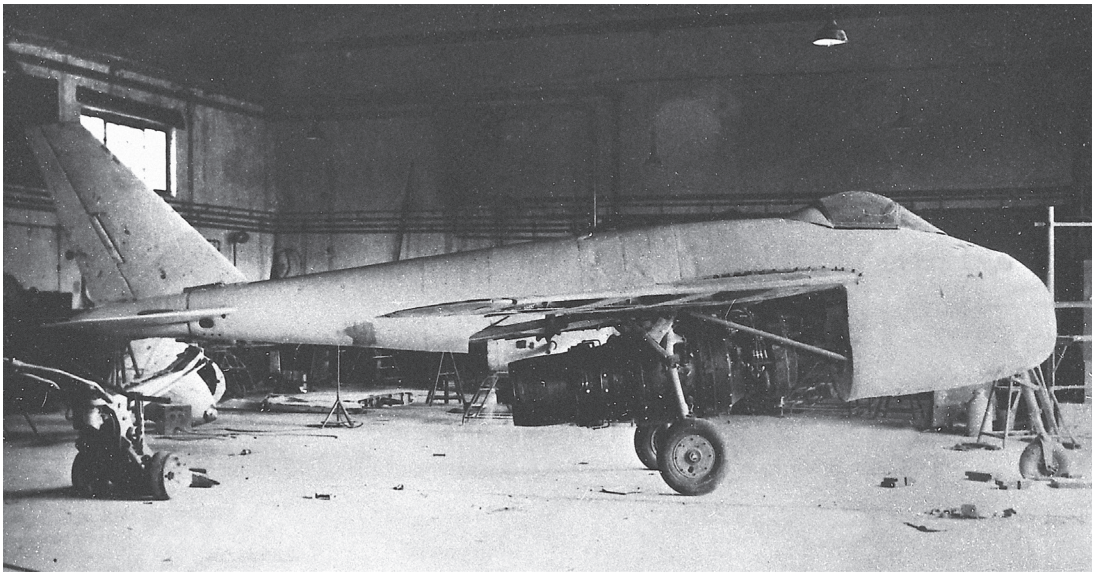
'In order to test the aircraft as quickly as possible and to accelerate later mass production, the following requirement is levied – use as many components and sub-assemblies as possible from the mass-produced Me 262, without modification.

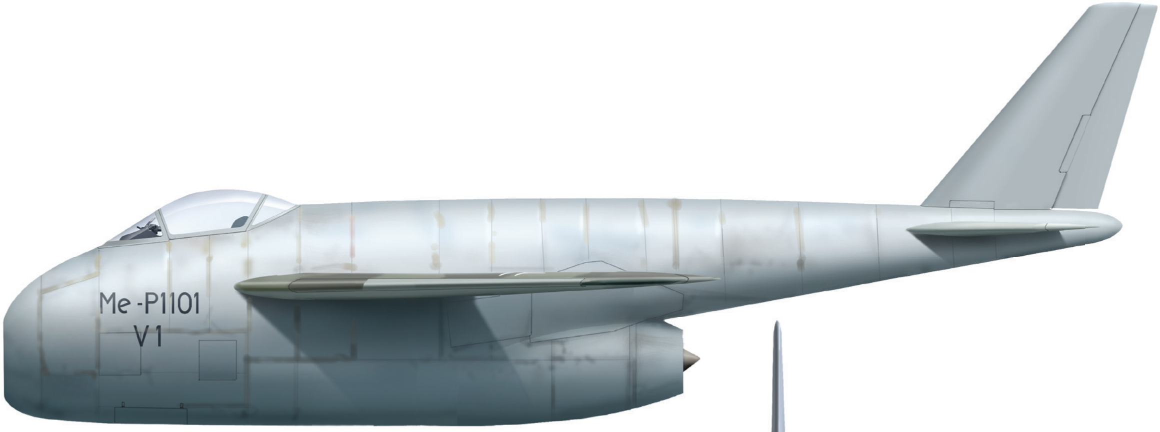
'The first aircraft will be built as an experimental aircraft – that is to say, it will be able to undergo modifications of the wing, fuselage and tail unit during testing.

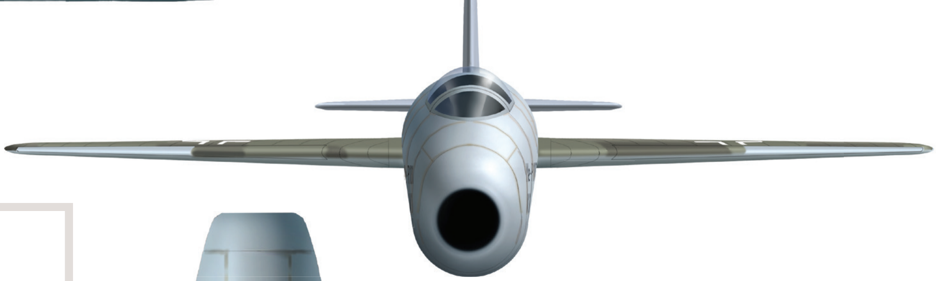
'The experimental aircraft can become the prototype for the production series, but that is not finite – i.e. a longer processing period might be necessary for thorough testing of the configuration, the status of various items of equipment for the individual stages of development and for testing flight characteristics of the highly swept wings and tail unit and their response at over-critical Mach numbers, and for studying the sturdy fuselage sections with jet effect.'

The fuselage comprised upper and lower cylindrical sections which were linked together, with the air intake duct bedded in the lower section. The wings were based on those of the Me 262 and swept back 40 degrees, although the 'experimental' prototype was to include a pivot at the point where the spars joined that allowed, essentially, the wings to be adjusted to sweep back either at 35 or 45 degrees at quarter chord. The aileron and leading edge slats were taken from the Me 262. There was to be an angle of incidence fluctuation of between +2 per cent and -3 per cent. The tailplane was to be built of wood, with as many as six different options being considered, including normal, V-tail and T-tail configurations. There was to be a pressurised, all-round vision cockpit and a tricycle undercarriage.

The Messerschmitt P.1101 V1 at Oberammergau shortly after the war. The photograph offers a good view of the bubble canopy, undercarriage construction and engine installation. However, the HeS 011 engine seen here was a mock-up. Note the sorry condition of the nosewheel tyre.

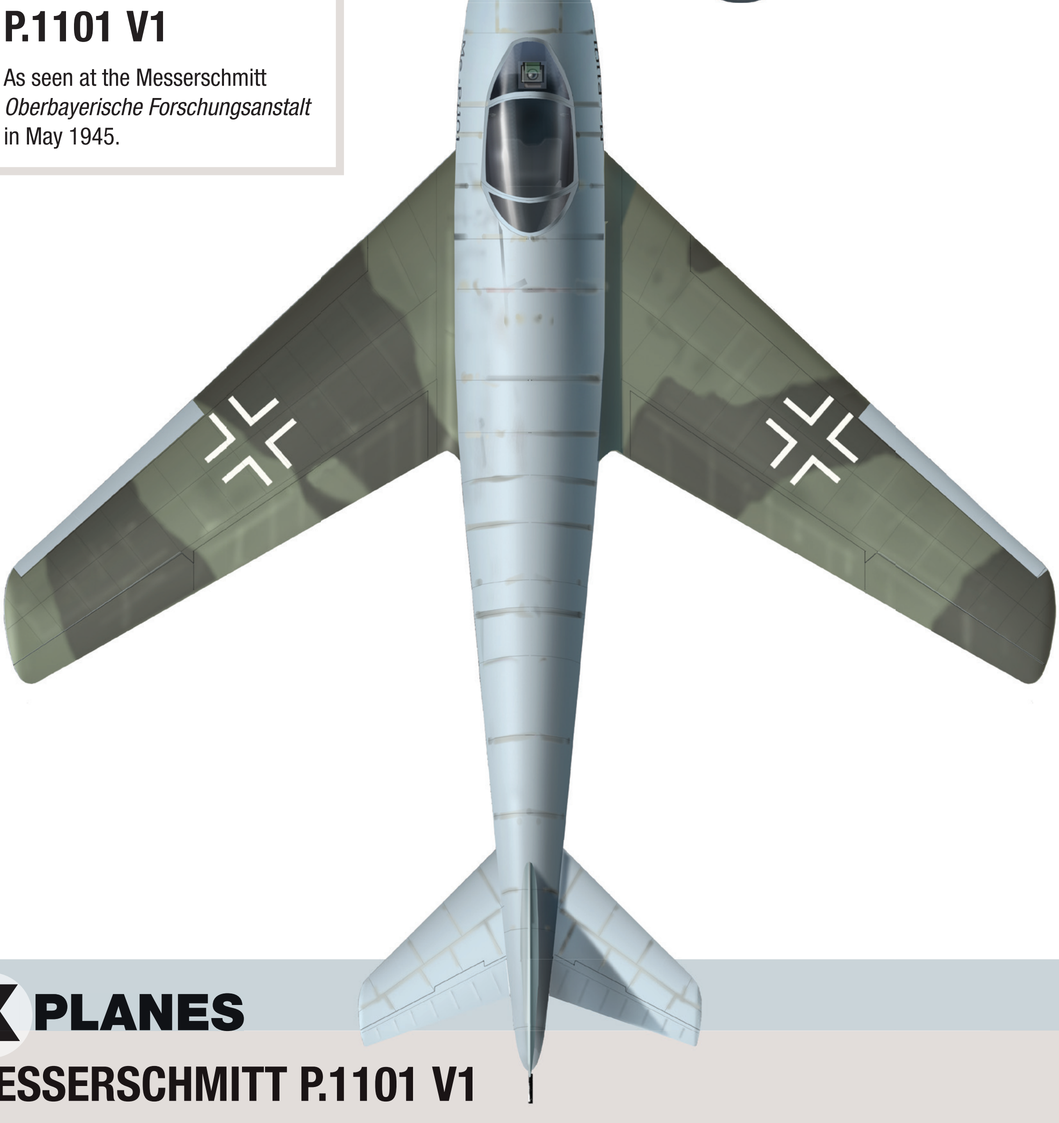


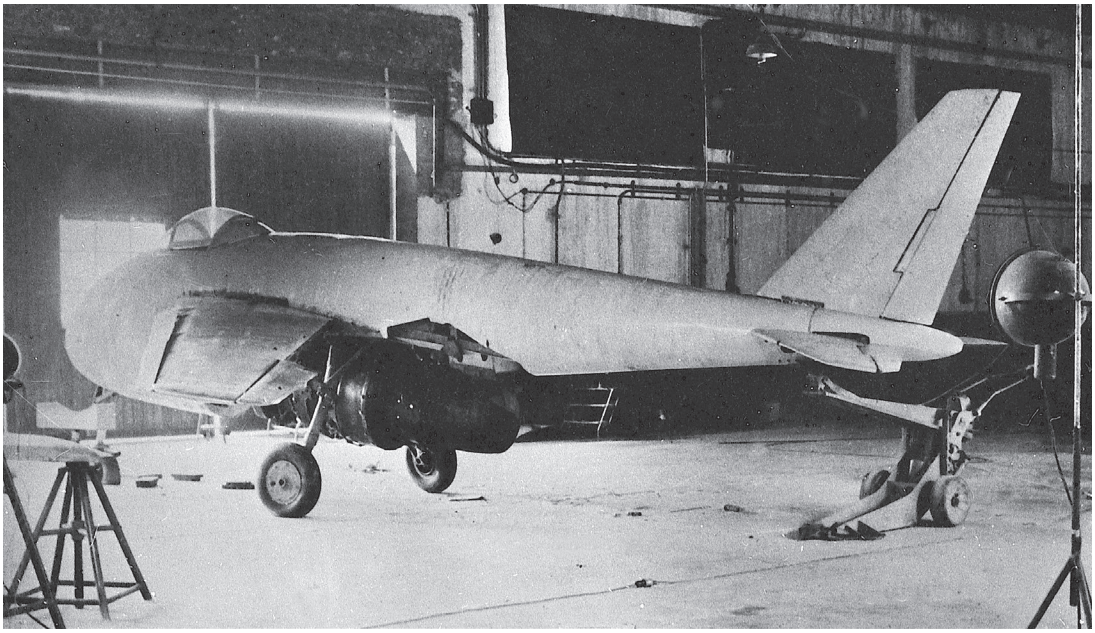




Messerschmitt P.1101 V1

As seen at the Messerschmitt *Oberbayerische Forschungsanstalt* in May 1945.



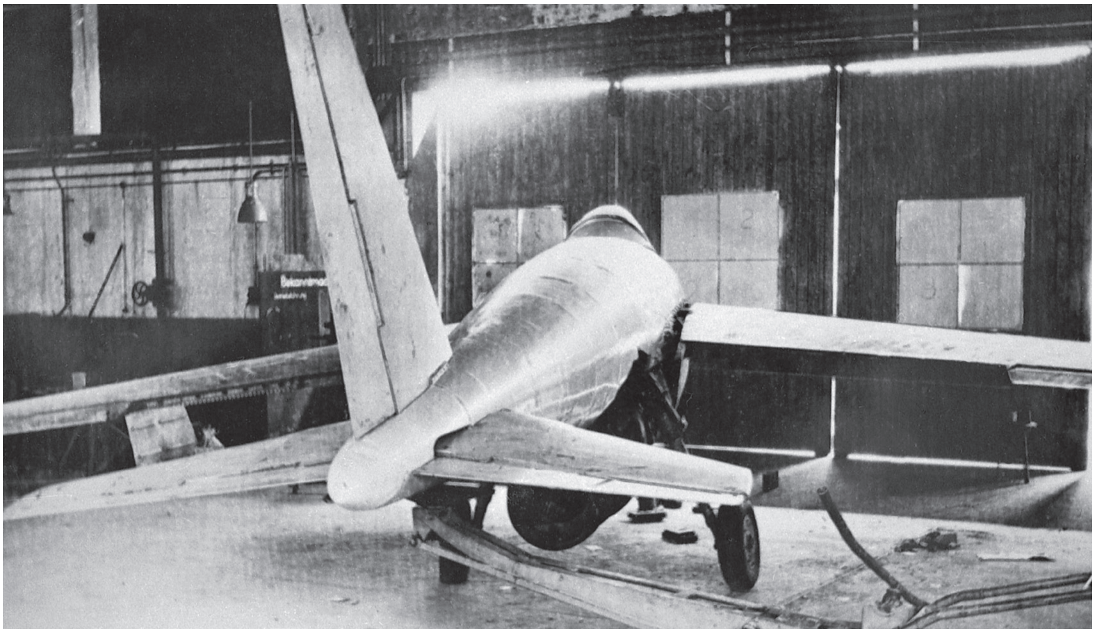


The Messerschmitt P.1101 V1 was found by the Allies in a near completed state in a hangar at the *Oberbayerische Forschungsanstalt* (Upper Bavarian Research Institute), a deliberately vague cover name given to Messerschmitt's project and design office housed in the Bavarian town of Oberammergau.

Messerschmitt's designers were also mindful of the flame that would jet out from the HeS 011 engine on start-up and therefore planned to line the underside of the fuselage area around the exhaust with steel plate. Any equipment installed near to the end of the engine would have to be protected against heat. But it was noted that steel would have to be kept away from the area of the master compass.

Messerschmitt also built a model with a wingspan of just under two metres in order to assess rudder, slats and flaps at the DVL wind tunnel at Berlin-Adlershof. However, at around the time the P.1011 was transferred to the Kobü, and without official sanction from the RLM, work also commenced on the first prototype aircraft in what had once been the former mule stables of the *Gebirgsjäger* (mountain infantry) barracks at Oberammergau, to where from October 1943 Messerschmitt's project, construction and statistics departments had been relocated from Augsburg. By October 1944, Messerschmitt had some 2,230 of its employees working at Oberammergau under the guise of the innocuously named '*Oberbayerische Forschungsanstalt*' (Upper Bavarian Research Institute), in an attempt to conceal their true purpose from the Allies and their bombs.

Construction of the P.1101 prototype, with its duralumin fuselage and plywood-lined wing emulating that of an Me 262, proceeded in the prototype production department, apparently alongside the Me 262C-2b *Heimatschützer* II rocket-boosted fighter fitted with two BMW 003 TLR composite turbojet and rocket units. Sheet metal parts and pre-fabricated components were made in the Messerschmitt workshops at Augsburg and Oberammergau and transported on vehicles operated by the *Organisation Todt* (OT) civil engineering and labour force. Over the next few months, under the supervision of Meister (Foreman) Moritz Asam, head of the *Versuchsbau* (experimental



Sun and electric light glint off the bare metal uppersurface of the P.1101 V1's fuselage in its crude hangar at Oberammergau in May 1945. The rear of the aircraft is supported by a towing rig. Despite appearances, aerodynamically, the aircraft was probably the most advanced under construction anywhere in the world at the time the photograph was taken.

construction workshops), and with Professor Messerschmitt also keeping a watchful eye, construction proceeded quite rapidly.

In order to achieve maximum speed, Messerschmitt wanted a clean build with a perfect surface finish, free of protruding rivets and join lines. The fuselage was readied for the installation of a Jumo 004 engine, but it could be easily retooled for the accommodation of an HeS 011. The canopy was of the low-drag variant, the so-called 'racing' canopy as used experimentally on the Me 262 V9, and could be kept free of mist through the circulation of warm air drawn from the engine. In the cockpit, the instrument panel contained airspeed, turn and bank and rate of climb indicators, altimeter, auxiliary compass, rpm indicator, gas pressure meter, fuel injector pressure gauge, lubricant pressure and fuel capacity indicators.

One thousand litres of fuel was housed in the centre fuselage in four tightly riveted, unprotected tanks, with the engine lying beneath. The latter was separated from the fuel area by a fire-proof bulkhead. Radio equipment, oxygen system, directional control and master compass were housed in the rear half of the fuselage. The compass, at the very aft, was covered by a hood of non-steel material. The vertical and horizontal tail sections were made of wood, with the rudder joined to the fin at three points. Steering was based on the same system used in the Me 262, and the non-braking, 465x165mm nosewheel featured an enclosed, hydraulic flutter damper. The 660x190mm mainwheels could be braked. Power supply came from a 3,000-watt generator. It was intended not to fit the first prototype with armament or protective armour.

It was hoped that an inaugural test-flight could be attempted at the Messerschmitt and Luftwaffe jet training base at Lechfeld in March 1945, the aircraft to be moved there on a specially converted OT vehicle.

By early 1945, four operational variants (see below) of the P.1101 were being planned, but despite this advanced stage of prototype development, very unusually the RLM did not assign the P.1101 a dedicated GL/C number:

P.1101 *Schönwetter-Jäger* I

Fine-weather fighter, with reduced avionics equipment, Jumo 004B engine and two MK 108 cannon. Provision for 300-litre drop tank.

P.1101 *Schönwetter-Jäger* II

Intended to replace the *Schönwetter-Jäger* I, a fine-weather fighter with pressurised cockpit, powered by an HeS 011 engine, with FuG 218, FuG 06 and FuG 500 radio equipment, EZ 42 gyro-stabilised gunsight, K 15 autopilot, MK 108 cannon.
Optional armament (one set of the following):
Pair of underwing 21cm WGr.21 air-to-air mortars.
Twelve SG (Sonder Gerät – 'Special Apparatus') 116 'Zellendusche' ('Cell Shower'), recoilless, single-shot, 30mm MK 103 cannon barrels fitted to a breech block and intended to be fired upwards as the fighter passed below a bomber.
SG 117 3cm Rohrbatterie or Rohrblock 108 comprising a battery of seven barrels each containing one 30mm MK 108 cannon round for use against bombers. The barrels were clustered cylindrically, held together by a metal brace, running to a breech block and fired by means of an electric connection. The shells left the barrels sequentially.
Four Ruhrstahl X4 guided missiles.
Two Hs 298 guided missiles.

P.1101 *Schlechtwetter-Jäger*

Bad-weather fighter to attack targets in conditions of poor visibility. To carry four Ruhrstahl X4 guided missiles or two Hs 298 guided missiles.

P.1101 with HeS 011R

Equipped as per the *Schlechtwetter-Jäger* but intended for deployment against high-altitude enemy aircraft using an HeS 011R engine fitted with an auxiliary rocket motor to provide extra power boost for interception. Plans were also made to include an ejection seat, and underwing RATO packs could also be fitted to all variants.

CHAPTER NINE

HENSCHEL Hs P.135

The Berlin-based Henschel Flugzeugwerke, a subsidiary of Henschel und Sohn of Kassel, one of the world's largest manufacturers of railway locomotives, buses, lorries and machine tools during the 1930s, enjoyed a solid reputation as an aircraft firm during that decade and subsequently throughout World War II. Henschel not only built Junkers Ju 86s and Ju 88s and Dornier Do 17s under licence it also developed its own range of aircraft, including the Hs 123 close-support biplane and the Hs 126 tactical reconnaissance aircraft, both of which first saw service during the Spanish Civil War. Later, the company produced the successful twin-engined Hs 129 ground-attack aircraft as well as the Hs 293 rocket-powered, anti-shipping glide bomb and other guided bombs and air-to-air missiles.

The man behind many of Henschel's designs was the firm's chief aircraft designer, Dipl.-Ing. Friedrich Nicolaus. Born in Darmstadt in 1893, Nicolaus studied philology before serving in World War I, after which he learned to fly gliders and qualified as an engineer. It was during the early 1940s, having joined Henschel, that he first explored the possibility of producing a twin-engined jet aircraft, but he later abandoned the plan in favour of a revised specification known as the Hs P.135.

Then, in late 1944, when the RLM issued its request for an emergency fighter design, Nicolaus pulled out the Hs P.135 and used it as a submission. This took the shape of a curious, if not innovative, single-seat, single-jet engine design featuring, as with other companies' submissions, a short, stubby fuselage but with slim, semi-delta wings with upturned wingtips intended to introduce stability during low-speed flight. The inner part of the wing had a leading edge sweep of 42 degrees, the central part 38 degrees and the upturned tips 15 degrees. The span was 9.2m and the total wing area was 20sq m.

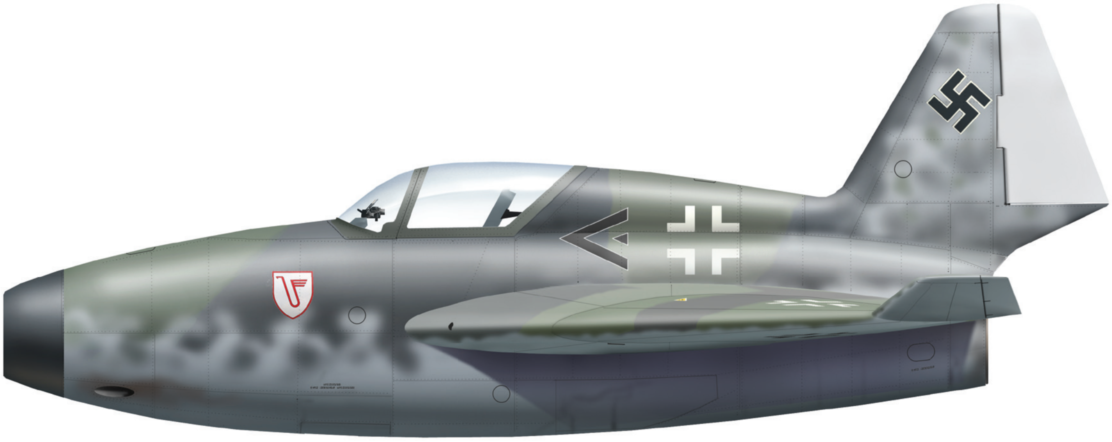
The design was such that significant high-speed performance could be achieved through an inherent reduction in air resistance, and a maximum speed of 985km/h was projected. The sharply reduced angle of sweep at the wing tip meant that turbulence was minimised by spreading out the compression effect along the length of the wing as Mach speed was approached, resulting in the Hs P.135 being able to carry more weight at higher speed. In comparison to the other designs, the fuselage was taller, wider and heavier, giving strength but without affecting performance.

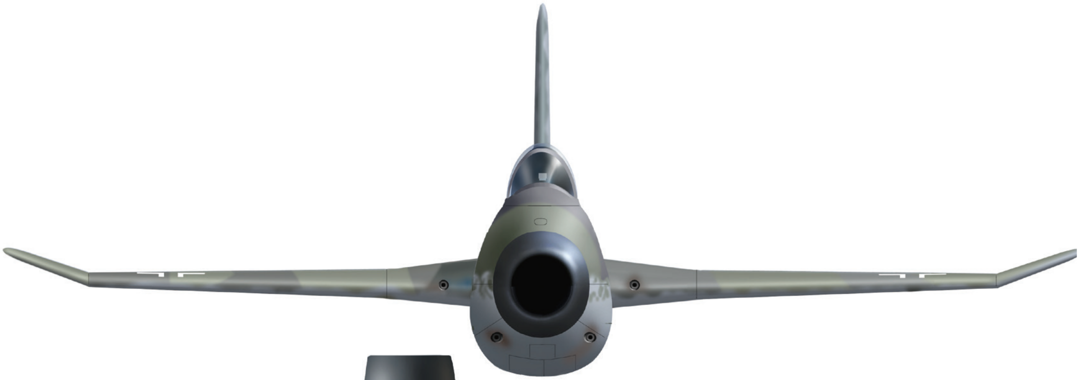
As with the other designs, the air intake duct ran from the nose, directly through the aircraft to a single HeS 011A-1 engine mounted to the aft of the fuselage. The nosewheel retracted aft, while the main gear retracted forwards. The cockpit was located in the centre of the fuselage and the canopy was faired in, behind which was a vertical fin and rudder that extended beyond the rear of the fuselage.

Armament consisted of either two or four 30mm MK 108 cannon in the nose, with a further such gun in each wing root. Fuel weight was planned at 1,600kg, with takeoff weight at 5,500kg.

Unfortunately, Henschel's design team at Berlin-Schönefeld was late in submitting its final plans, and, as a result, the Hs P.135 was never considered in detail by Knemeyer and his colleagues. The delay may have been due to what Nicolaus perceived to be a lack of seriousness surrounding the whole Emergency Fighter Programme owing to the unlikely availability of the Heinkel-Hirth engine. Indeed, in early 1945 Nicolaus decided to modify the Hs P.135 in order to fit the Walter HWK 509C rocket engine as the Hs P.136.

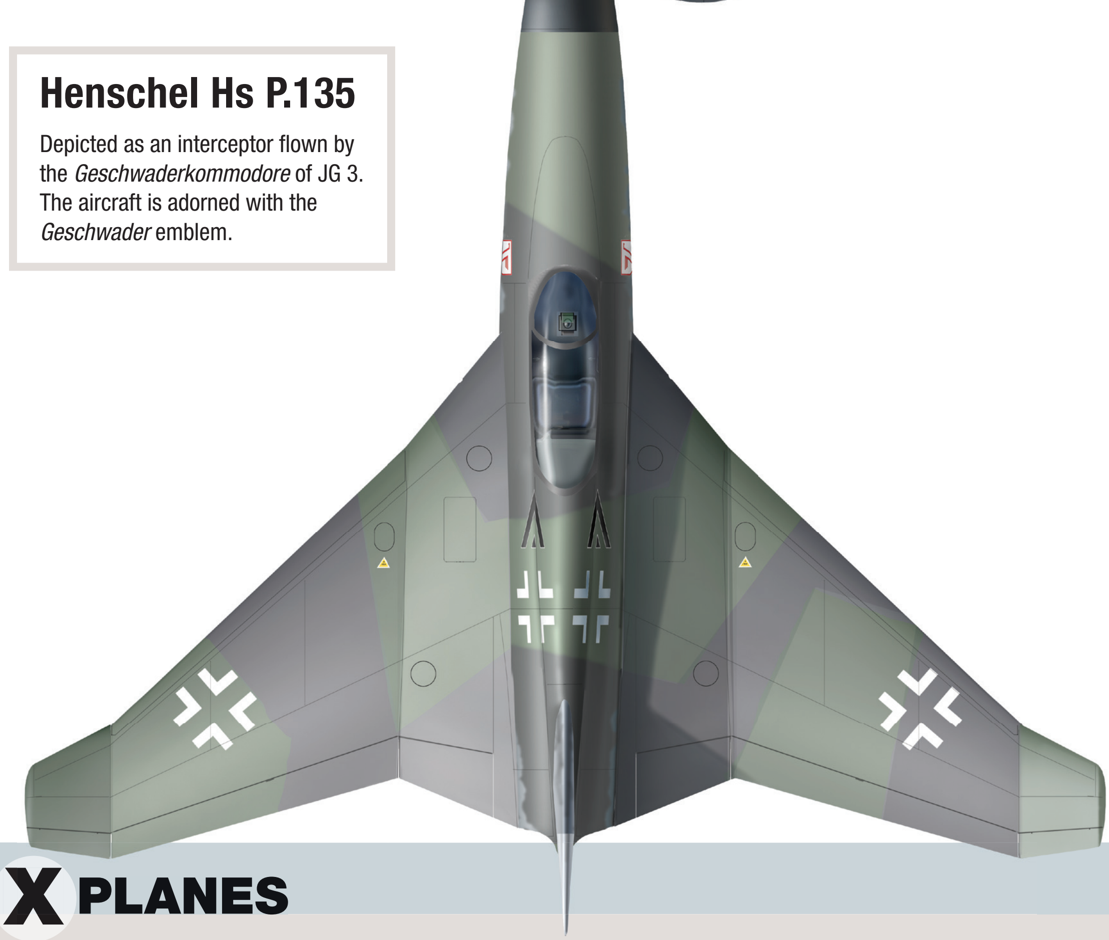
Dipl.-Ing. Friedrich Nicolaus was Chief Designer at Henschel and originator of the firm's P.135 semi-delta winged, jet project which was submitted to the RLM as an emergency fighter contender. Nicolaus joined Henschel before the war and remained with the firm throughout the conflict, finally serving in the Volkssturn civil defence force in 1945.

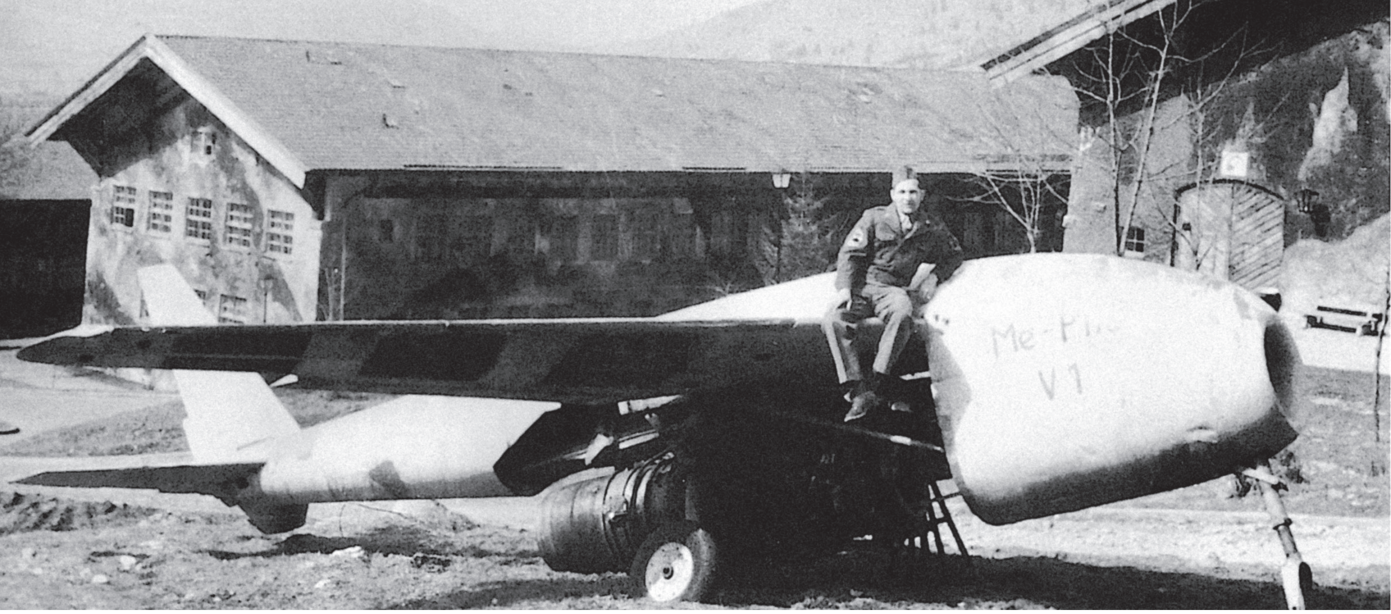




Henschel Hs P.135

Depicted as an interceptor flown by the *Geschwaderkommodore* of JG 3. The aircraft is adorned with the *Geschwader* emblem.





CHAPTER TEN

ASSESSMENT AND DECISION

War prize – May 1945 and a US serviceman poses for a photograph on the wing root of the Messerschmitt P.1101 V1 at the former mountain infantry barracks at Oberammergau used by Messerschmitt as the base for its projects office. The aircraft has been moved out into the spring sunshine from its hangar. The canopy is missing, as is the nosewheel and its cover, while the right-side mainwheel appears close to collapse. The rear of what is a dummy HeS 011 engine is also visible.

High in the skies to the west of Berlin on 28 February 1945, over the towns of Braunschweig and Brandenburg, a formation of some 15 Me 262 interceptors of III./JG 7 endeavoured to attack hundreds of '*Viermots*' of the USAAF's Eighth Air Force, but their efforts proved largely fruitless. Allied fighters were escorting the bombers, out to attack marshalling yards and rail junctions in the area, deep into Reich airspace. They were now ruling the skies over Germany virtually with impunity. A total of 212 jets had been squeezed from the factories during the month, with another 12 returned to operational units having been repaired after suffering battle damage, but it was not enough.

On the ground, Poland had been lost to the Russians at a cost of some 400,000 German servicemen. Alarmingly, the towns of Neustettin and Prenzlau, just inside the German border, had also been taken by the Red Army, while in the West, US forces were fast approaching the Rhine. Slowly, but surely, the Third Reich was being choked to its death.

But in an office in the RLM building in the centre of the German capital, with either indomitable or questionable optimism, Siegfried Knemeyer and his team of experts convened to consider the various projects put forward by the aircraft manufacturers for a new Luftwaffe 'emergency fighter' and to decide which design would become a reality.

Those present at the meeting were qualified men. They included Oberstabs-Ingenieur Dipl.-Ing. Helmut Schelp, the *Referent für Sondertriebwerke* (*Strahltriebwerke*) ('Expert on Special Engines [Jet Engines]') in GL/C-E 3 – the RLM section dealing with engine development. Having gained a master's degree at Stevens Institute in Hoboken, New Jersey, during the early 1930s, Schelp returned to Germany in 1936, where he undertook a course in advanced aeronautical engineering and pilot training at the DVL in Berlin. After successful completion of the course and with the rank of Flugbaumeister, he joined the *Technisches Amt* of the RLM. The following year Schelp began to study gas turbines and in 1938 was appointed to head the department responsible for such development (later he was also responsible for pulsejet and ramjet development). He then visited BMW, Bramo, Daimler-Benz and Junkers-Motorenwerke to encourage those firms to develop turbojet engines for high-speed flight.

Schelp's initial efforts to generate interest, however, were greeted with scepticism, but eventually he succeeded in getting BMW and Junkers to commence work on what became, respectively, the BMW 003 and Jumo 004 jet engines. But when Ernst Heinkel somewhat reluctantly approached the RLM in 1941 for assistance in the development of a new jet engine to improve on the HeS 08 that had powered the He 280 and to meet an RLM specification for a turboprop issued that year, Schelp readily supported the notion. Although he also broadly supported the BMW and Jumo designs, Schelp would eventually consider what became the HeS 011 to be Germany's most advanced engine.

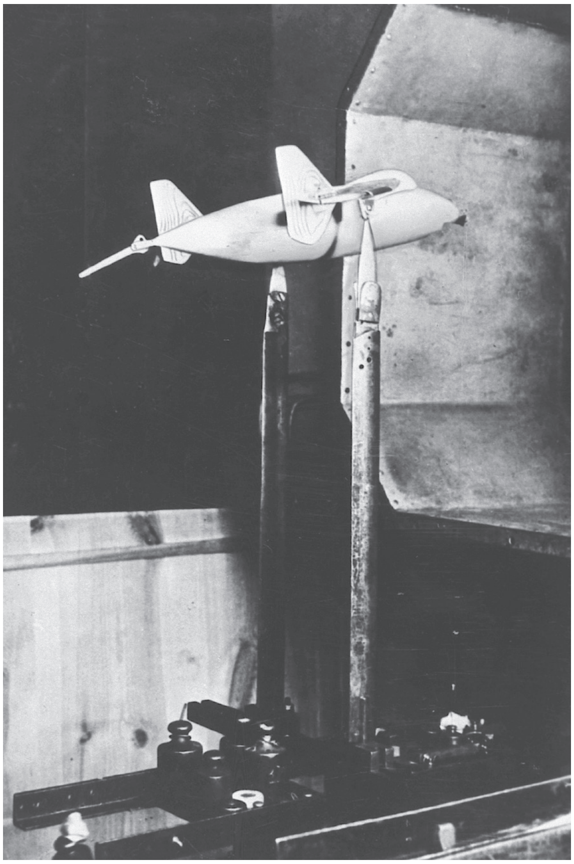
Also in attendance at Knemeyer's meeting was the Luftwaffe's senior engineer, Generalstabs-Ingenieur Dipl.-Ing. Roluf Lucht, who, since September 1944, had been head of the *Entwicklungs Hauptkommission Flugzeuge* (EHK – Main Development Commission for Aircraft) – a committee that had been formed on the orders of the Armaments Minister, Albert Speer, as well as the 'Emergency Aircraft Commission'. As such Lucht had been deeply involved in the recent *Volksjäger* project which ultimately saw production of the Heinkel He 162. During the 1920s he had worked as a marine engineer in the North Sea, but in 1926 he had joined the Rohrbach Metall-Flugzeugbau in Berlin for a brief period before transferring to the Reichswehr weapons office and the RLM Technical Office at its formation in 1933. A friend of Erhard Milch, he was known as an *éminence grise* and exerted considerable influence over matters concerning aircraft development.

Accompanying Lucht was Generalmajor Ulrich Diesing, the *Chef der Technischen Luftwaffenrüstung* (Head of Air Technical Equipment) at the RLM. A veteran of the Spanish Civil War, he had later served as a *Zerstörer* pilot, firstly with SKG 10 and then ZG 1, with whom he was appointed *Kommodore*. Accredited with 15 aerial victories, he was awarded the Knight's Cross in September 1942. That month Diesing joined the RLM as a representative of the *Stab des Luftwaffen-Führungsstabes* (Luftwaffe Operations Staff), but was appointed *Chef des Planungsamtes* C L/A (Chief of the Planning Office) in March 1944, before becoming Chef TLR in August of that year.

Also present were Major Otto Behrens, the commander of the *Erprobungsstelle* at Rechlin, Oberstabsingenieur Böttcher, head of TLR/Fl.-E2 and his colleague, Flügbaumeister Malz.

Unfortunately, much of the information and many of the proposals delivered to these men to study were patchy at best, mainly the result of 'the bad transport and communication facilities' at that stage of the war which, in turn, made the compilation of data such as production estimates difficult. One of the companies involved, Henschel, was late in delivering its Hs P.135 proposal and was therefore omitted from the assessment process.

Furthermore, it had been virtually impossible for the tendering companies to standardise their calculations. Worse still, because of this, the hoped-for advisory report from Professor Quick and Dr Höhler at the DVL in this regard was not forthcoming (see Chapter 3). This was largely because the manufacturers viewed their designs, which featured high-speed aerodynamics, revolutionary jet engines and swept wings, as breaking through conventional and accepted design parameters. As such, they believed they should be free to produce their own calculations in their own way and to create their own definitions, and in this they were not willing to compromise. The DVL had all but given up.



A small wooden model of the Junkers EF 128 undergoes wind-tunnel testing.

To fill the vacuum left by the DVL and in what must have been a somewhat biased move, it seems Knemeyer and his colleagues turned to Messerschmitt's '*Oberbayerische Forschungsanstalt*' at Oberammergau for assistance in preparing data and comparisons on the various designs submitted by Blohm & Voss, Focke-Wulf, Heinkel (EHAG), Junkers and Messerschmitt.

A month earlier, at the end of January, Diesing's staff at the TLR believed the BV P.212, EF 128 and Ta 183 to be the most promising, but Lucht and the EHK favoured the EF 128 and another single-engine, swept-wing Messerschmitt jet project, the P.1110, which Professor Messerschmitt saw as an enhancement to the 'experimental' P.1101. This situation resulted in some heated debate and disagreement among the assessors.

The aerodynamic specialists, designers and engineers at Oberammergau reported:

'In order to ensure the fairest possible comparison, reference was made to the performance and weights of all the designs submitted with regard to equipment and armament. The aircraft weights were determined against each other at the beginning of the performance comparison. The protective armour was not assured to be of equal weight for the individual designs, but the armour for each aircraft was set out so that an equal extent of protection was obtained wherever possible.'

	BLOHM & VOSS BV P.212.03	**FOCKE-WULF Ta 183**	**HEINKEL P.1078C**	**JUNKERS EF 128**	**MESSERSCHMITT P.1101**	**HENSCHEL Hs P.135**
Total Weight (kg)	4,180	4,300	3,920	4,077	4,064	4,100
Fuel Weight (kg)	1,200	1,200	1,200	1,200	1,250	1,200
Wing area (gr) (m^2)	16.9	22.5	17.8	17.6	24.5	20.5
Wing area (net) (m^2)	14.00	19.75	16.13	15.3	15.85	15.3
Takeoff wing loading (kg/m^2)	248	191	220	232	256	200
Span (m)	9.50 (including outer wing sections)	10.0	9.0	8.90	2.58	9.20
Length (m)	7.185	6.3	6.10	6.45	9.17	7.75
Height (gear down) (m)	3.15	3.6	2.4	2.63	3.71	4.20
Tail area (m^2)	1.0	2.8	-	3.0	1.4	2.18
Maximum speed (km/h) at altitude of 7km	966	959	988	987	985	984
Climbing speed at sea level (m/s)	21.0	20.3	20.9	21.2	22.2	21.2
Landing speed (km/h)	186	164	179	175	172	155
Takeoff distance to 20m altitude (m)	?	1,050	?	?	?	?
Ground run (m)	840	670	700	790	700–750	690
Service ceiling (km)	12.4	13.7	12.9	13.75	12.0	14.0
Endurance	Approx max 4hrs on max fuel capacity of 2,100ltrs + 300ltrs in aux. tanks.	2hrs at 55 per cent power at DGW (650km/h – 1,300km)	?	?	?	?
Range (km)	?	990km at max thrust. 1,300km at 55 per cent thrust.	1,500	?	1,500	1,000
Armament: cannon options	2x/3x/5x/7x MK 108 2x MK 103 + 2x MG 151 1x MK 112 + 2x MK 108 3x MK 108 + 1x SC 500 bomb	4x MK 108	2x MK 108	2x MK 108	2x or 4x MK 108	4x MK 108
Additional weapons options	22x R4M + 2 MK 108	500kg (SD 500, SC 500 or BT 200)	-	2x MK 108	-	500kg ordnance load

By the end of February, however, it seems things had calmed. The ‘judges’ were happy to tread water with regard to the Blohm & Voss submission, having talked to representatives of the company only a week earlier, when it was agreed that production of three BV P.212 prototypes should go ahead, the first two of which were to be ready by August and September 1945, respectively. Based on Blohm & Voss’s assurances that the wings and various materials would undergo strengthening, a contract would be issued by the RLM in due course. The company was to wait for the paperwork.

When it came to the Heinkel P.1078C, the DVL expressed concerns over the wing fuel tanks, which were unprotected, as well as the wing profile. They also felt that the cross-section shape of the fuselage was not conducive to high speeds and that the setting of both the air intake and the nosewheel would cause problems. The DVL also commented, ‘The inverted Vee formed by the marked anhedral at the wingtips, intended to perform the function of a tailplane, would not make the aircraft easy to handle in the turn. Efficient operation of ailerons and tail flaps would seem to be ruled out by the angle of wing sweep.’ With such a negative response, EHAG seems to have ceased further work on the project.

Debate then centred on the respective merits and shortcomings of the Focke-Wulf Ta 183, the Junkers EF 128 and the Messerschmitt P.1101.

Dr Georg Backhaus in the Aerodynamics Department of Junkers had continued to carry out wind tunnel tests with models of the EF 128 in varying states of completion at Dessau, paying particular attention to the shape of the air intakes to ensure the least resistance, and the company was working towards series production of the aircraft commencing in mid-1945. But when Professor Quick and Dr Höhler appraised the design they became concerned about potential technical failures arising from duct loss caused by the intake arrangement. There were also issues connected with the leading edge split flaps which, in the DVL’s view, needed replacing by normal slats, as well as the question of torsion on the wing where it was feared that the lateral shape of the aircraft combined with its tailless fuselage could result in a reversal of aileron forces at high speed. This was something that no doubt irked Professor Dr-Ing. Hertel, the torsion specialist.

However, the RLM men did approve of the EF 128’s maximum speed of 990km/h at 7,000m, as well as the weapons arrangement and gunsight provision. Indeed, at a conference of the EHK at the Badehotel in Bad Eilsen on 23 March 1945, in a somewhat bizarre and unrealistic move, which was becoming increasingly symptomatic of the decision-making taking place within the upper echelons of the Nazi hierarchy, and despite the DVL’s concerns, it seems Knemeyer authorised a development contract for the EF 128. This followed approval, or possibly instruction, from the Führer’s personal ‘Plenipotentiary for Jet Aircraft Production and Operational Deployment’, Obergruppenführer und General der

Waffen-SS Dr-Ing. Hans Kammler, who was now the SS overlord in such matters.

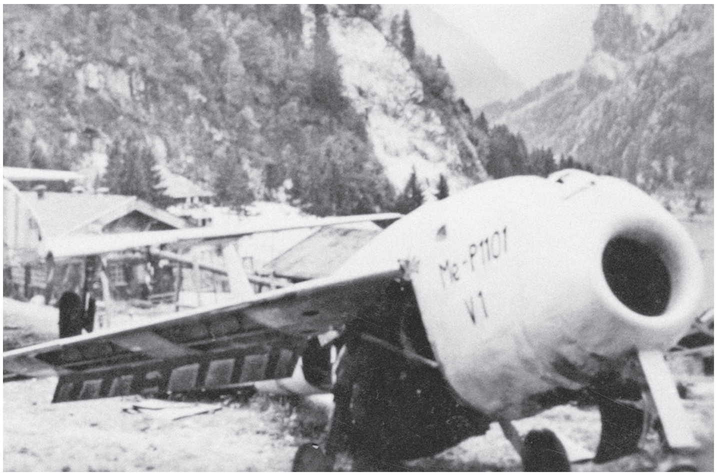
Beyond that point, however, until war's end, nothing further appears to have happened on the Junkers project. Thus, effectively, the competition broke down into a 'two-horse race' between the Ta 183 and the P.1101. At 965km/h, the Ta 183 lacked an acceptable maximum speed, whereas Messerschmitt projected a top speed of 1,080km/h for the P.1101. Another problem identified by the RLM was that the Ta 183's highly swept vertical tail and its relatively high aspect ratio would probably have presented difficulties during high-speed flight, with the boundary layer flowing in the direction of the horizontal tail.

The crucial point is that there was no clear winner of the Emergency Fighter 'competition'. Disagreement and hesitation between Knemeyer and his team was partly responsible, as was the fluidity and unreliability of completion dates and production estimates, as well as the overshadowing realities of a war which Germany was losing. The whole process was inconclusive. Agreement was given for Messerschmitt to proceed with the completion of the P.1011 V1 and then to undertake flight-testing – if for no other reason than the fact that construction of the aircraft was underway. However, it is fair to say that the P.1101 probably represented the tangible zenith of advanced German aircraft design by war's end – and for that matter advanced design anywhere in the world. Certainly, the prototype would impress the Americans in the early post-war years (see Chapter 11).

But if one design gained the most all-round support, it was the Ta 183. The reasons for this are not clear, but they did result in the RLM awarding Focke-Wulf with a contract for the building of a series of prototype aircraft. Focke-Wulf documents show 1 March 1945 as being the date the official order to commence work was received. Indeed, by the end of the war, the construction of full-size Ta 183 mock-ups was underway, as ordered by Tank, and Focke-Wulf had commenced manufacturing equipment and components at its plant at Bad Eilsen near Bückeberg. It was planned that the Ta 183 V1 would make its inaugural flight as a flying air-test 'dummy' powered by a Jumo 004 in May or June 1945, about the same time as the P.1101 would make its own maiden flight. For the V1's early flights and those of the ensuing V2 and V3 (also test dummies), pending arrival of the HeS 011, improved Jumo 004B1 engines would be used, fitted with a modified compressor and turbine in order to reduce vibration and with thrust increased to 8.83kN.

Subsequently, the V4 to V13 would be built as full

One of the most technically and aerodynamically advanced aircraft in the world at the time, the P.1101 V1 lies forlorn against a backdrop of Bavarian mountains at Oberammergau in May 1945. Behind it is the engineless, incomplete airframe of an Me 262 minus its nose section.

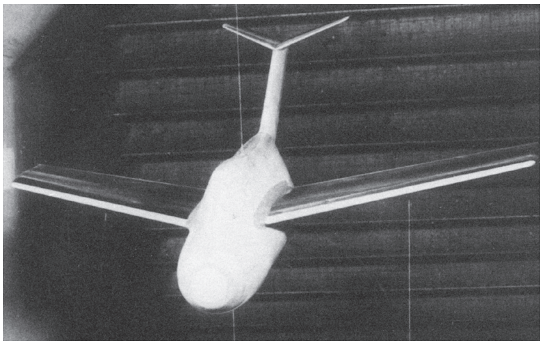


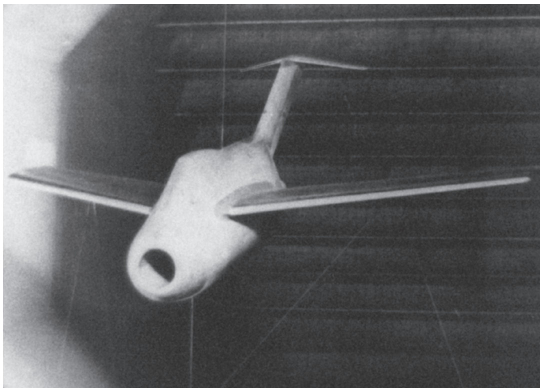
Muster-Flugzeuge (type aircraft) and fitted with the anticipated Heinkel-Hirth engine, while the V15 and V16 would be used for further advanced works-testing and data analysis. It was hoped that the V4 would fly in August 1945, with the first Ta 183A-0 production aircraft following in October, assuming the RLM gave its approval. In addition to the prototypes, two further airframes would be constructed, each as a *Bruchversuchs-Zelle* or static destruction-test airframe, to be known as the Ta 183Br 1 and Br 2 and for testing by the *Werkstoffversuchsabteilung* (Materials Testing Department).

As of 1 March 1945, Focke-Wulf's planned prototype programme for the so-called '*TL-Jäger – Projekt Multhopp*' saw the production of 13 prototypes (consecutively the V1–V13), plus two *Bruchversuchs-Zelle*, but in an RLM Industrie-Lieferplan issued just seven days later, the first three prototypes were renamed as the Ta 183A-1, A-2 and A-3, presumably to differentiate the early Jumo 004-powered machines from later HeS 011-fitted examples, although curiously the A-3 is shown as being installed with the HeS 011. The production schedule was as follows:

Ta 183 V1 (RLM A-1?) Flight-ready 15 June 1945 (Jumo 004 B1)
V2 (RLM A-2?) Flight-ready 3 July 1945 (Jumo 004 B1)
V3 (RLM A-3?) Flight-ready 21 July 1945 (Jumo 004 B1)
V4 (RLM V1?) Flight-ready 11 October 1945 (HeS 011 on all following aircraft)
V5 (RLM V2?) Flight-ready 25 October 1945
Bruchversuchs-Zelle 1 Completion 25 October 1945 – to the *Werkstoffversuchsabteilung*
V6 (RLM V3?) Flight-ready 15 November 1945
V7 (RLM V4?) Flight-ready 22 November 1945
Bruchversuchs-Zelle 2 Completion 15 November 1945 – to the *Werkstoffversuchsabteilung*
V8 (RLM V5?) Flight-ready 6 December 1945
V9 (RLM V6?) Flight-ready 13 December 1945
V10 (RLM V7?) Flight-ready 20 December 1945
V11 (RLM V8?) Flight-ready 27 December 1945
V12 (RLM V9?) Flight-ready 3 January 1946
V13 (RLM V10?) Flight-ready 10 January 1946

Focke-Wulf projected a period of three-and-a-half months as being needed from what it termed the 'launch date' (i.e., the day the order was received from the RLM) to completion of the Ta 183 V1. After an initial preparation period of four weeks in which final, detailed drawings would be prepared, work would commence on the V1 on 1 April 1945, with the aircraft envisaged as being flight-ready on





TOP Wind tunnel models of the Ta 183 were used by Hans Multhopp to calculate aerodynamic performance, in this case with what appears to be a covered intake and dihedral horizontal stabilisers.

ABOVE Here, the model has had the intake cover removed and the horizontal stabilisers are anhedral in form. The final design would settle on a dihedral arrangement.

15 June, a total manufacturing period of six weeks. As work proceeded on the V1, construction of the V2 would start on 15 April and the V3 on 30 April. Each of the first three prototypes was expected to take between 36,000 and 40,000 man-hours to complete.

Production of the first HeS 011-fitted machine, the V4, was planned to commence on 15 June. The manufacturing time for each machine thereafter was expected to decrease successively from 45,000 man-hours for the V4 to 32,000 hours for the V13. By July 1946, monthly production was planned at 300 aircraft, which would require a labour force of 3,600 workers.

The immediate problem was engines – or the lack of them. By 1945 all Jumo 004s were needed by the Me 262 units for the air defence of the Reich, but even that requirement was hampered by the Allied bombing of the transport network. A small number were slated for delivery to Focke-Wulf in January, but it is unlikely that they were ever delivered to Bad Eilsen. If any Ta 183 airframes were actually completed, they would have been wanting for engines.

By April, the adverse war situation killed off any hope of progress when British troops reached Bad Eilsen on the 8th of that month. At the Focke-Wulf plant, the workforce had managed to destroy the bulk of the company's most secret files and papers, but the British did capture and hold Professor Tank for interrogation. Over the coming days, convoys of military lorries arrived, onto which Focke-Wulf employees were ordered by the British to load whatever drawings, papers, filing cabinets, technical books and instruments interested them. Even desks and chairs were taken.

Meanwhile, in late March, during their advance into southern Germany, elements of the French First Army took the small town of Wertach in the Oberallgäu. Here, by chance, they stumbled across 23 metal containers and eight steel tubes into which Messerschmitt personnel had secreted and dispersed the production files and drawings for the P.1101 and other advanced Messerschmitt projects. Realising their technical significance, for the time being, the French held onto them, sending them to Paris for inspection.

On 27 April 1945, with the assistance of a few conscripted foreign workers, some of the last remaining German technicians at the Messerschmitt facility at Oberammergau hauled the almost completed P.1101 V1 from its assembly area and moved the aircraft to a large underground storage room in order to protect it from Allied bombing.

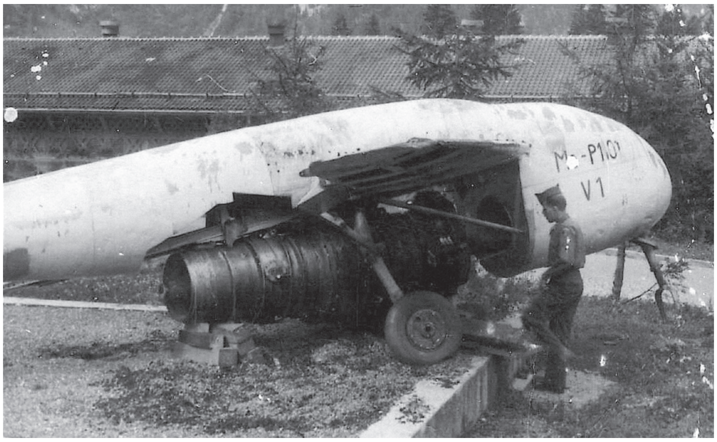
Two days later, an infantry unit of the US Seventh Army finally entered Oberammergau and discovered the aircraft, which had been fitted with a mock-up of an HeS 011 engine. The American infantrymen immediately moved it once again, this time to a crude hangar, apparently denting the nose area in several places in the process. On 7 May members of a US Combined Advanced Field Team (CAFT), one of 28 such teams formed in February to roam through freshly captured territory looking for technical 'targets of opportunity', arrived to inspect the P.1101. The CAFT personnel called in Air Technical Intelligence specialists, who arrived on 21 May and among whom was Robert J. Woods, chief design engineer of the Bell Aircraft Corporation of Buffalo, New York. Woods, described by an American aviation journal in 1939 as 'one of the world's outstanding aircraft designers', was astonished and extremely impressed at the 'war prize' – a highly advanced, high-speed jet fighter with variable swept wings in a state of near completion.

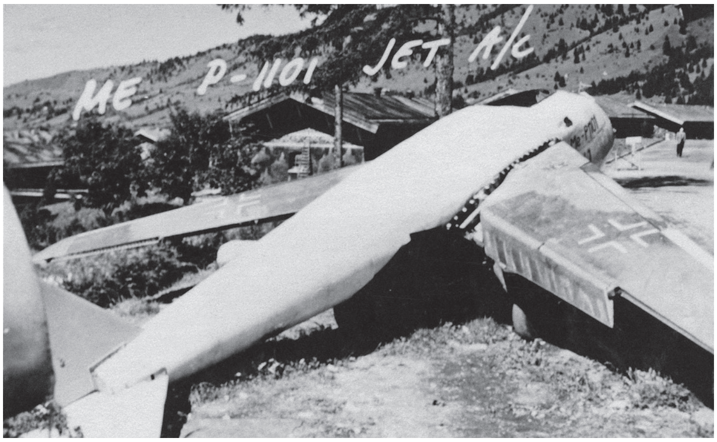
Having discussed the idea with Dipl.-Ing. Voigt, Woods actually proposed to senior US air technical personnel that the Messerschmitt engineers be allowed to complete their work on the jet so that it could be brought to flying condition and properly evaluated. His suggestion was declined, and the P.1101, with a battered nose, missing engine and wing panels, and minus its technical documentation, which was still in the hands of the French, was left abandoned and exposed to the elements. One young American serviceman who had the opportunity to inspect the aircraft at close-hand was Cpl Arthur Hansen of the 323rd Military Intelligence Detachment, who was attending the US Army Intelligence School at Oberammergau. He recalled:

'I remember seeing the aircraft and wondering what it was. My first thought was that it was some type of V1-style weapon, but upon closer inspection I realised that it was a very advanced aircraft, this being the first time I had seen an exposed jet engine. Out of curiosity, I recall looking down the intake of the engine and seeing the compressor blades and noted that the undersides of the wings were in an un-skinned state. I couldn't see into the cockpit, but I did wonder why it hadn't been removed and taken to the US. Not until four years later when I was flying in Korea for G-2 as an Aerial Observer for the 3rd Infantry Division, and the F-86 Sabre was phased in, did I think of that aircraft again, as the shape of the Sabre reminded me of the P.1101, and I thought to myself, "I wonder if we copied the design", and also how the Messerschmitt was way ahead in technology.'

Eventually, the P.1101 was prepared for shipment to the USA.

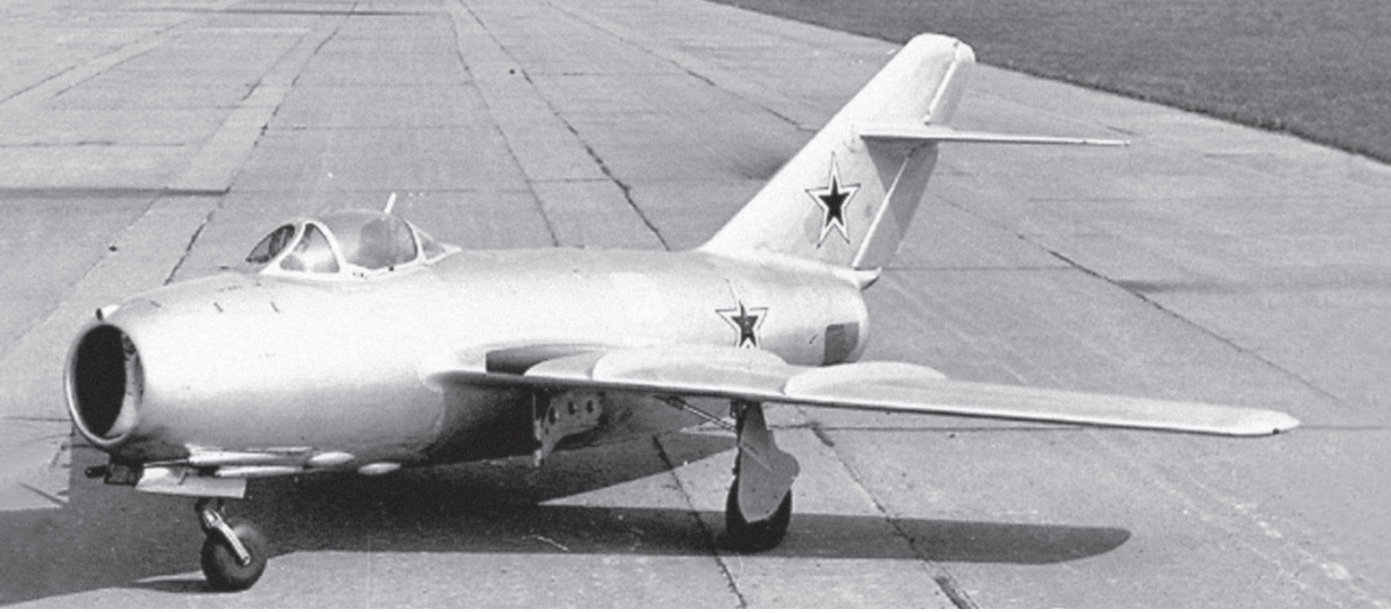
With that, Siegfried Knemeyer's goal for an advanced single-engined jet fighter ended, but the interest of the competing Allied powers in his plans did not.





TOP Cpl Arthur Hansen of the 323rd Military Intelligence Detachment, but assigned to the US Army Intelligence School at Oberammergau, examines the semi-derelict P.1101. The aircraft's nosewheel is missing, the undersides of its wings lack skinning, and the rear of the HeS 011 mock-up engine has been propped up on a pile of bricks. Note also the areas of filler paste on the bare metal fuselage and what are possibly bullet holes in the centre section above the wing.

ABOVE While the fuselage of the P.1101 V1 was left in bare metal and filler paste, the wings had received a splinter pattern camouflage, probably in RLM 71/72 or using 73, 74 or 75. The wings also bore later-war national crosses.



CHAPTER ELEVEN

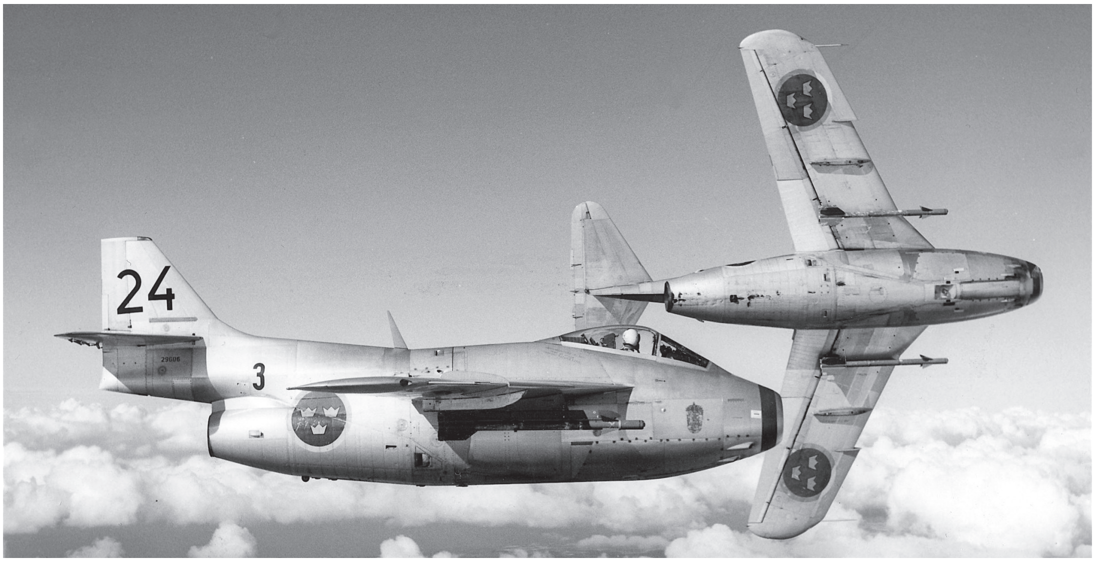
A LEGACY OF DESIGN

Artem Mikoyan and Mikhail Gurevich may well have drawn some inspiration from Hans Multhopp in certain aspects of the design of the MiG-15 fighter. This example, with its nose intake and swept-back wings and tail, is the first production MiG-15, No 101003, photographed during acceptance trials with the NII VVS following enhancements. The two small blisters on the lower forward fuselage house NR-23 cannon.

In the aftermath of World War II, the Allied powers inevitably hungered for the technology that powered the German jets, and there is little doubt that, to some extent, the aircraft manufacturers of the victorious powers were influenced by the late-war designs of Blohm & Voss, Focke-Wulf, Heinkel, Junkers and Messerschmitt. In May 1946, in a report prepared for the Analysis Division of the USAAF's Air Technical Intelligence (T-2) section, 1Lt R. J. Baker of the Headquarters of the Air Materiel Command at Wright Field recommended that 'The novel design and construction of the single-jet fighter plane [the Ta 183] should be studied further with the possibility of incorporating some of its better features in future AAF jet planes'.

Many sources state that after the fall of Berlin in May 1945, the Red Army located a treasure trove of DVL documents related to research on the Ta 183 and the effects of swept-wing design amidst the abandoned rooms of the RLM building in the German capital. This material was, understandably, sent back to the Soviet Union where it was studied with interest by, amongst others, Artyom Mikoyan and Mikhail Gurevich of the MiG OKB (*Opytnoye Knostruktorskoye Buro* – Experimental Design Bureau).

In March 1946, Josef Stalin asked the design teams of the leading Soviet aircraft manufacturers to create a daylight fighter capable of operating from primitive, forward airfields and of intercepting high-flying bombers at 11,000m, as well as carrying out ground-attack missions. The aircraft had to be able to climb fast and to fly at Mach 0.9 with an endurance of at least one hour.



Two Saab J 29Fs of the *Flygvapnet*'s F3 wing based at Malmslätt, fitted with AIM-9 Sidewinder missiles. It is believed that the Swedes obtained details of the Ta 183 soon after the war. The underside view of the J 29 bore a strong similarity to Kurt Tank's design.

However, it is facile to conclude that the magnificent MiG-15 jet fighter that emerged in late 1947 was simply a 'copy' of Hans Multhopp's wartime design. Indeed, the Russians had examined the possibilities offered by jet-powered flight well before the war had ended and the *Tsentrahlnyy aeroghidrodinameecheskiy Institut* (TsAGI – Central Aerodynamics Institute) had been studying the concept of the swept wing since 1935. Furthermore, the Soviet Union had had no hesitation in adopting Jumo and BMW engine technology in the early, though underpowered, MiG-9 jet fighter. More probably, MiG's engineers, headed by A. G. Brunov, would have been 'inspired' by the '*Huckebein*' and thus, most likely, 'influenced' to some extent by its 'concept', comparing it with their own straight, swept-back and swept-forward wing designs. For the new requirement they settled on a swept-back wing of 10.08m span at 25–35 per cent of the chord.

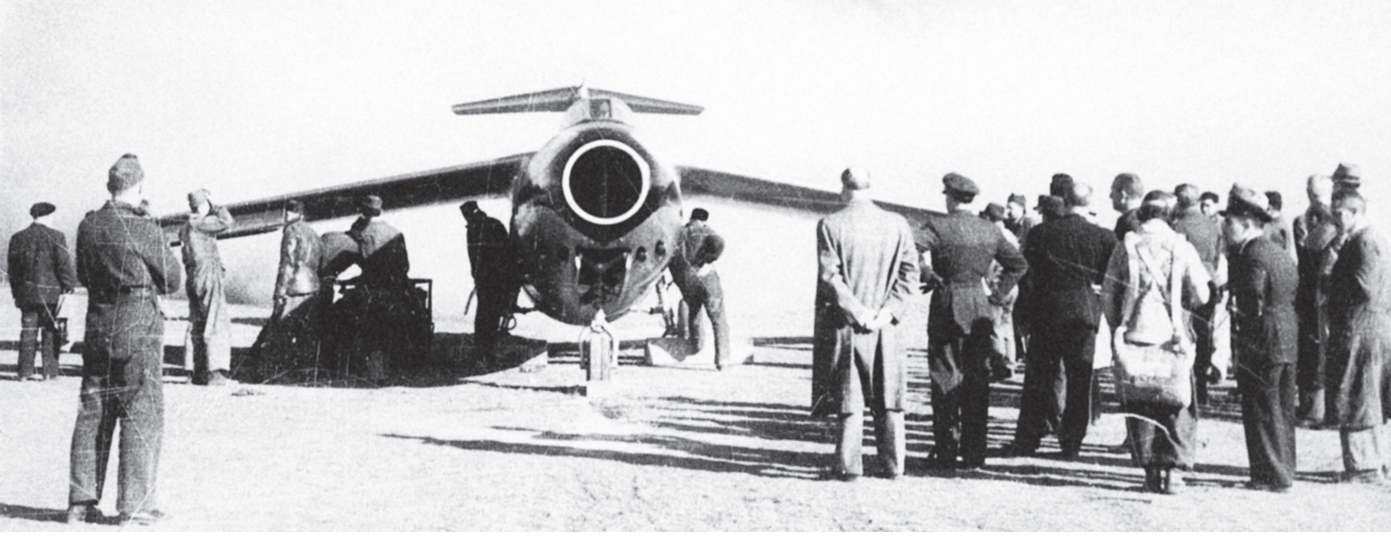
Certainly, when it emerged as a production aircraft from the GAZ (*Gosudarstvenny Aviatsionyy Zavod* – State Aviation Factory), the MiG-15 did bear a striking resemblance to the Ta 183, particularly with its short, 10.1m fuselage and swept-back, cruciform tail fin and vertical stabiliser. An intake duct, split in two by a partition which housed the retracted nosewheel, fed air from the nose, past the cockpit section to either the Rolls-Royce Nene II or Klimov RD-45 or RD-45F engine in a principle similar to that of the Ta 183. Armament was fixed at a single 37mm N-37D cannon (40rpg) and two 23mm NS-23KM or NR-23 cannon (80rpg).

The MiG-15 first saw operational service at the beginning of 1949 with a home-based air defence division, before being deployed in numbers to North Korea from June 1950. In Korea, Soviet and Chinese pilots gave a good account of themselves in an aircraft that was heavily armed and which was found to handle well in combat conditions, proving itself a potent adversary for the United Nations pilots and aircraft – even the USAF's F-86 Sabre – during the encounters that took place over 'MiG Alley', as the China–North Korea border area around the River Yalu became known.

It should also be borne in mind that, unlike the Western Allies, the Soviets did not have the benefit of capturing the originators of the Ta 183, Kurt Tank or Hans Multhopp, or for that matter Willy Messerschmitt, or, initially at least, Siegfried Günter of Heinkel.

Meanwhile, it seems that the Swedes also had the chance to study plans for the Ta 183 in the immediate post-war period, and it can only be speculated as to how neutral Sweden came to have this opportunity. In a feature on the new Saab 29 (later J 29) written in May 1950, a journalist for the British *Flight* magazine wrote archly of the aircraft's development, 'Another important acquisition was German information on high-speed flight and swept-back wings. More expeditiously than the Western Allies, the bilingual Swedish engineers were able to put this data to good account in their design deliberations.' Design work commenced shortly after the war in October 1945, and wind-tunnel tests followed at the Aeronautical Research Institute in Stockholm. After ironing out what the Saab technical staff referred to as 'certain early aesthetic imperfections', they were able to convince the *Flygvapnet* (Royal Swedish Air Force) of the merits of their work.

Certainly, the new fighter of 1951 bore marked similarities to the Ta 183. The Saab J 29, known as the '*Flygande Tunnan*' ('Flying Barrel') on account of its rounded shape, was built around a central air duct, leading to a licence-built de Havilland Ghost turbojet engine, the SFA RM 2, of 5,000lb static thrust. It earns itself a place in military aviation history as the first operational Western European jet fighter with a swept wing. Like the Ta 183, the J 29's 10.23m fuselage also contained gun armament, landing gear and fuel, and the cockpit was located over the central, circular air intake. The aircraft was sturdy and was designed to operate from grass airfields. It was built of large, sheet metal detachable panels, similar to Multhopp's principles, and



Civilian and military personnel gather around the Pulqui II (No 2) at Córdoba, in Argentina, on 27 June 1950, shortly after its successful first test flight with Capt Edmundo Weiss at the controls. Note the mechanics kicking the wheel chocks into position and the presence of a second pilot in a flightsuit and with a seat parachute to the right.

featured a single-piece, two-spar, swept wing attached to the fuselage by four bolts. The stabilisers were fully manoeuvrable, the automatic leading edge flaps were of light-alloy castings, the ailerons and flaps ran the entire length of the 11m wingspan and there was a Saab-designed ejector seat. Maximum speed was given as 1,035km/h (Mach 0.86).

The Saab 29 prototype's maiden flight took place on 1 September 1948 with British test pilot Sqn Ldr Robert Moore DFC at the controls, and the first J 29A production machines were delivered to the *Flygvapnet*'s F13 wing at Norrköping in 1951. Several further fighter versions followed, as well as a reconnaissance variant, and the aircraft succeeded in breaking two world speed records when speeds of 977km/h for 500km and 900.6km/h for 1,000km were attained, respectively, in 1954 and 1955. The Austrian Air Force took delivery of 30 J 29s in 1961–62, and the *Flygvapnet* deployed 11 aircraft to the Democratic Republic of Congo between 1961 and 1963 to support the United Nations' effort there, where they proved to be reliable and resilient in the ground-attack and reconnaissance roles.

For their part, Kurt Tank and Hans Multhopp parted ways after the war. Multhopp was moved by the British to London for interrogation. Recognising the technical value of their captive, the British offered Multhopp the opportunity to stay. He found employment as an aerodynamicist at the Royal Aircraft Establishment (RAE) at Farnborough, and while there, he worked on various swept-wing planforms and designs for high-speed research aircraft. He also managed to calculate the angle of lift-off along a wing span without a computer. This was considered remarkable and his efforts were later used in the early design work for the British swept-wing, supersonic English Electric Lightning interceptor of the Cold War era. But after four years working at the RAE, Multhopp's apparent 'arrogance' could no longer be tolerated and he was dismissed.

With post-war Britain struggling to fund new projects, it suited Multhopp to leave for the USA, where he took up a position with the Glenn L. Martin Company in Baltimore. Here, he worked on the XB-51 tactical bomber and the P6M Seamaster jet flying boat, designs which incorporated T-tails. Later, he was appointed chief scientist for Martin Aircraft and the American aerospace business, Martin Marietta. He was involved with Martin's pioneering work on lifting body space designs such as the unpiloted X-23/PRIME re-entry vehicle (Precision Re-entry Including Maneuvering reEntry), the SV-5 high-volume lifting body, which became the centrepiece of a new USAF programme known as 'START' (Spacecraft Technology and Advanced Re-entry Tests) established in January 1964, and the associated X-24 group of lifting bodies that provided data for the NASA Space Shuttle programme.

An aerospace engineer employed at the NASA High-Speed Flight Station, R. Dale Reed remembered Multhopp from this time:

'In early 1964, I visited the Martin Aircraft Company to gather information on the SV-5 and possibly gain some support from

Martin and the Air Force in convincing NASA management to fund a supersonic lifting-body flight-test program. I met Hans Multhopp, introduced to me as Martin's chief scientist and the designer of the SV-5. A soft-spoken man with a heavy German accent, Multhopp seemed to be highly respected and admired by others in Martin Engineering. After a conversation with him about the SV-5, I could understand why he was so highly respected, for his knowledge of aerodynamics and aircraft design was impressive. My first meeting with Multhopp in early 1964 also turned out to be my last. After that visit, he seemed simply to disappear from public view.

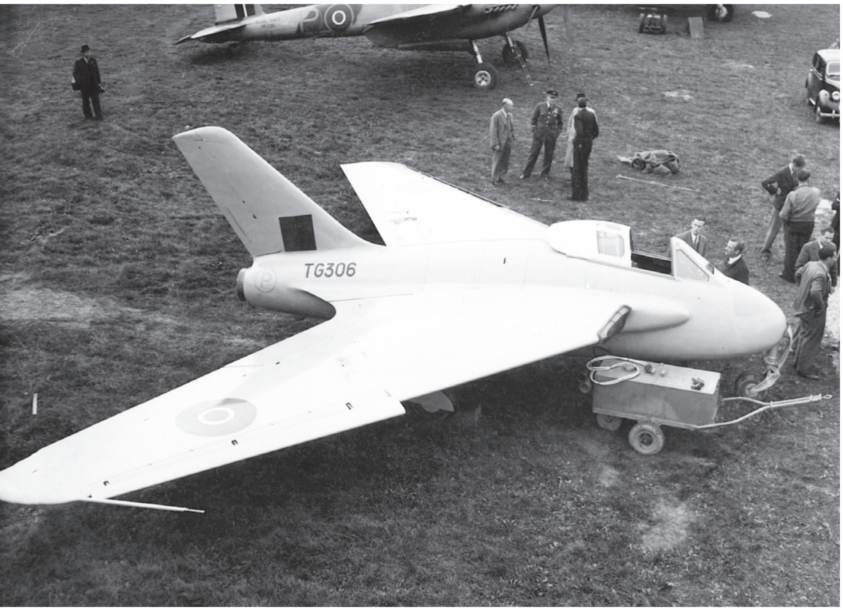
'Later, when the X-24A was being flown at Edwards Air Force Base as the final stage of the PILOT portion of the SV-5 program, I was surprised to learn that my Air Force colleagues at Edwards had never even heard of Hans Multhopp. At that time, there was still considerable resentment in this country about using German engineers in American aerospace projects. Consequently, it became the usual practice to keep German engineers at low profile.'

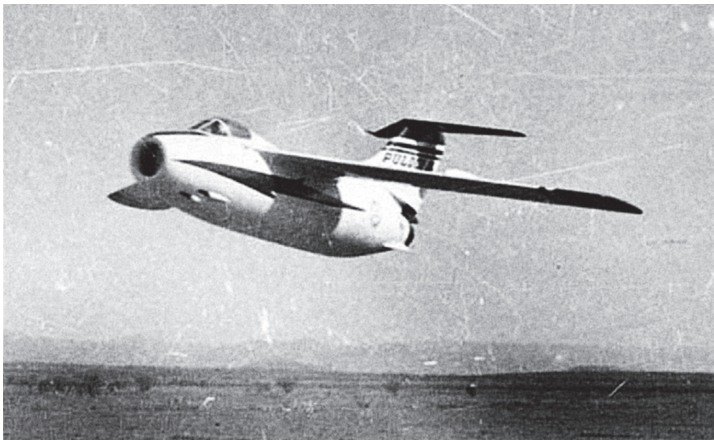
Notwithstanding that, Multhopp continued to work in the US aerospace industry and wrote a detailed paper on 'The Challenge of the Performance Spectrum for Military Aircraft – The Meaning of Speed' for the American Society of Automotive Engineers in 1965. He died seven years later, at the age of 59, in Cincinnati, Ohio.

After a series of fruitless, post-war discussions with the British, the Russians and the Chinese, Professor Kurt Tank managed to leave Europe covertly in late 1947. His new life was to be in Juan Perón's Argentina, where he commenced work at the IA Fabrica Militar de Aviones (FMA) in Córdoba along with, eventually, some 70 or so of his closest former Focke-Wulf personnel – designers, aerodynamicists, and material specialists – and their families, who had elected to join their much-respected boss in South America. It was in Córdoba that Tank would continue work on the Ta 183.

By the time Tank and his fellow Germans established their community on the slopes of the hills near Córdoba, FMA employed 6,000 workers and was the largest manufacturer of aircraft in South America. The company had built the Fw 44 Stieglitz under licence as well as other foreign aircraft and engines. It had also built the IAe 27 Pulqui (Arrow) I, which had the distinction of being South America's first jet aircraft and which had been conceived by the French designer Émile

Designed by John 'Jack' Frost, the tailless, swept-wing de Havilland DH 108 Swallow experimental aircraft was used to evaluate swept-wing handling characteristics at low and high subsonic speeds and later up to supersonic speeds. It is possible that Frost may have taken interest in, and drawn inspiration from, the tailless designs of Professor Dr-Ing. Heinrich Hertel and the Junkers firm, such as the EF 128. The DH 108 first flew in May 1946. Seen here is the second prototype, TG306, which had a 45-degree swept-back wing. Unfortunately, on 27 September 1946, while being flown by Geoffrey de Havilland Jr, the aircraft suffered a fatal structural failure while diving from 10,000ft at Mach 0.9 and crashed into the Thames Estuary. De Havilland was killed. The DH 108 was Britain's first swept-winged jet aircraft and also the first British tailless jet aircraft.





'We were able to realise what we'd only been able to dream of' – the Pulqui IIe (No 5) makes a low-level pass during a test-flight in Argentina in late 1959. Under the supervision of Professor Kurt Tank, the Pulqui II became the first swept-wing jet fighter to be entirely developed and built in Latin America, but it suffered from the political environment in Argentina and had been cancelled by 1960.

Dewoitine, who had also worked in Argentina in the immediate post-war years, having been accused of collaboration with the Germans during the war. However, a lack of power and poor handling characteristics meant that the non-swept Pulqui I did not enjoy a long future and flight-testing was cancelled in 1950.

Tank and his team then made their timely intervention, commencing work on what became the Pulqui II. This design was greatly influenced by the Ta 183 and became South America's first swept-wing jet. In the absence of an HeS 011, the aircraft was powered, like the early MiG 15s, by a Rolls-Royce Nene II turbojet and the wings were swept back at an angle of 40 degrees, while the horizontal stabilisers were mounted on top of the tail fin and swept back at 45 degrees. Armour was provided around the cockpit and a bulletproof windscreen was incorporated. Fuel capacity was initially 1,250 litres internally and 800 litres in the wings. Armament was planned at two 20mm cannon mounted in a staggered, near-ventral position on each side of the fuselage slightly set back from the jet intake. A main difference to the Ta 183 was that the wings were set higher, resulting in a shoulder wing design, and the rear of the longer fuselage sat much closer to the ground.

These elements introduced some aerodynamic uncertainty, and so in order to avoid risking a finished prototype in tests, Tank came up with the novel idea of building a full-size, unpowered but airworthy model of the aircraft, built of wood and stretched fabric in the manner of a glider. He made several flights in the model, which was towed into the air by a twin-engined IAe 24 Calquin light bomber before being released at 2,000m. The flights proved trouble-free, and after each flight Tank would make any necessary minor adjustments.

The powered Pulqui II (No 2) first took to the sky on 27 June 1950, flown by an Argentinian pilot, Capt Edmundo Weiss, who had experience on the Meteor F 4 which then equipped the *Fuerza Aérea Argentina* (Argentine Air Force) and for which the Pulqui was viewed as a potential successor. All went well. On 23 October, Tank assumed the role of test pilot himself and made no fewer than 28 flights between then and 31 May 1951, including one before President Perón in Buenos Aires. 'I climbed to around 8,000m altitude in just six minutes and was quite proud to have launched what was probably the fastest fighter in the world at the time together with my colleagues, so far away from home. We were able to realise what we'd only been able to dream of long before with our Ta 183 model experiments at Focke-Wulf', Tank subsequently noted.

But one such flight almost proved fatal when the Pulqui II (No 2) went into a dangerous stall. The aircraft nosed over and lost control. Tank recalled, 'It became clear to me that I was falling almost straight down like a rock with the aeroplane in a perfectly normal flight altitude.' Fortunately, Tank managed to recover, and solved the problem by adding ballast to the nose in order to shift the centre of gravity forward.

There was no such luck for fighter pilot Capt Vedania Mannuwal when he took to the air in the afternoon in the Pulqui II (No 2) following Tank's 28th flight during the morning. Mannuwal crashed into mountains near Córdoba after a wing broke away from the aircraft as he was undertaking aerial manoeuvres. The pilot had attempted to bail out at low altitude but he was killed. Faulty welding was deemed to be responsible.

Worse was to come. One of the men that followed Tank to Argentina was Otto Behrens, an accomplished wartime Fw 190 pilot with JG 26 who rose to the rank of Oberstleutnant and who had been appointed to command the Luftwaffe's test centre at Rechlin during the final months of the war. Perhaps the greatest irony was that he had sat on Knemeyer's emergency fighter committee. On 11 October 1952, Behrens flew the third prototype Pulqui in a fateful flying display for Perón during the President's visit to the FMA factory. At one point during the demonstration, Behrens had descended towards the airfield and then attempted to pull up in a spiral turn, but then fell into an inverted spin. He attempted to recover but had to put the aircraft into a steep dive, and in doing so his wing touched the ground. The Pulqui broke apart and the debris was scattered across the field. Behrens was killed.

Despite these damning adversities, Tank and his team persevered and produced a fourth prototype, which benefited from extended range and incorporated fences on the wings to counter the stall threat, a pressurised cockpit, increased fuel tankage and four 20mm Hispano-Suiza HS.404 cannon.

In retrospect, however, had Tank chosen to stick with Multhopp's mid-wing structure, the performance of the Pulqui II may have been more assured. As it was, the location of the wing spar in relation to the Rolls-Royce Nene engine dictated that he was forced to move the wing. But in Argentina Tank had no wind tunnel to conduct further tests.

After four years of development and testing, in January 1955 the Perón government decided not to renew Tank's contract. Nine months later, a coup d'état ended Perón's second presidential term. With a strained economy and the arrival of a new military junta in Argentina, a shadow fell over the Pulqui's future, as well as general developmental work at FMA. A great number of Tank's colleagues were forced to leave the country for work in the USA, or to return to an uncertain future in the new Federal Republic of Germany.

In 1956 Kurt Tank went to India, where he worked for Hindustan Aeronautics on the Marut fighter-bomber, the first military aircraft to be built in India. He remained there until the late 1960s. During the 1970s Tank returned to Germany, where he worked for MBB as a consultant. However, he later fell ill and died in Munich-Harlaching in 1983.

Besides the Ta 183, the Russians also took a brief interest in the EF 128 when their forces occupied the Junkers works at Dessau in May 1945. Under orders from Soviet intelligence officers, captured Junkers engineers produced a report on the EF 128. What aroused Russian interest was the fact that the Germans estimated that development work could be completed within six months. This was enough to make the Soviets think seriously about proceeding with the construction of a prototype, but ultimately these thoughts were abandoned – mainly because of restrictions on manufacturing capacity – in favour of other Junkers projects, including the EF 126 pulse-jet powered fighter and EF 131 and EF 132 jet bomber projects.

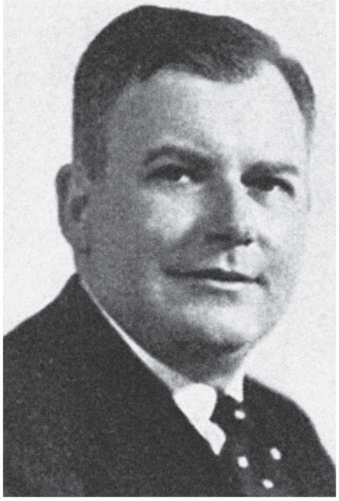
It is quite possible that John Frost, the project engineer at the British firm of de Havilland, was also inspired by the late-war project designs of Junkers when he came to work on the tailless, swept-wing DH 108 experimental aircraft, known unofficially as the 'Swallow'.

But one of the planned 'emergency fighters' advanced to a greater stage of post-war development and had more direct influence on post-war design than any of the others.

In the summer of 1945, the Messerschmitt P.1101 V1 was partially disassembled at Oberammergau and shipped, together with a second set of wings, to the United States. This move had been at the instigation of Robert J. Woods, the Chief Engineer of the Bell Aircraft Corporation of Buffalo, New York. A native of Youngstown, Ohio, Woods had worked as a junior engineer in the wind tunnel section of the National Advisory Committee of Aeronautics (NACA) at Langley Field, Virginia, early on in his career, before becoming assistant chief engineer of the Towle Aircraft Company of Detroit, where he designed a small, twin-engined, all-metal seaplane. He then worked at the Detroit Aircraft Corporation as a project engineer on flying boat designs and pursuit aircraft. He later joined Lockheed at Burbank, followed by a period at the Consolidated Aircraft Corporation at Buffalo, working on various USAAC pursuit and attack designs, before joining Bell.

Woods was described in a contemporary aviation magazine as 'a big, serious-minded, 200-pound six-footer, intensely interested in very tiny detail as well as in the final result. He's typical of that unsung, little-honoured fraternity which worked so long and late over the drafting boards in the engineering departments of the aircraft factories, worrying little about much credit and getting mighty little of it too – but so meticulous and accurate in their work so that they can tell exactly what their latest creations will achieve in every detail months before the test pilots get at them.'

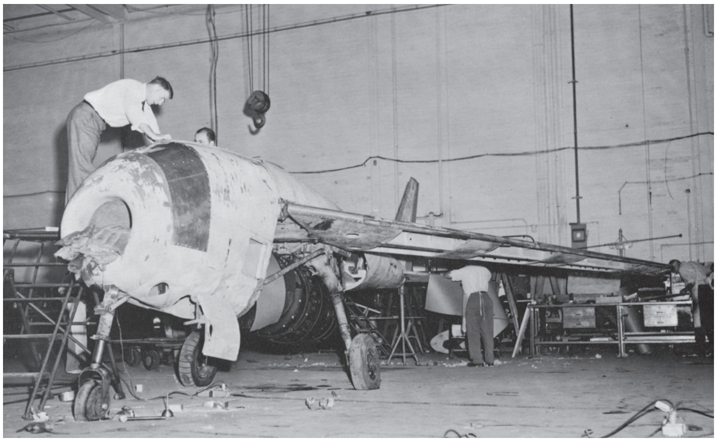
On 1 August 1946, Woods' report, 'A Survey of Messerschmitt Factory and Functions, Oberammergau, Germany' was published by the Air Materiel Command at Wright Field, Ohio. Also at Wright Field was the P.1101 V1 with its spare wings. The aircraft had undergone considerable examination since its arrival in the USA, having been fitted with an Allison J35 axial-flow compressor turbojet. Working with Woods at Wright Field was Dipl.-Ing. Woldemar



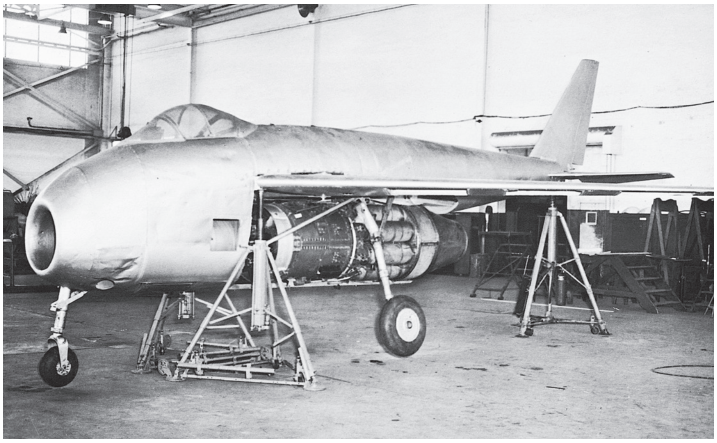
Robert J. Woods, the meticulous Chief Engineer of the Bell Aircraft Corporation, recognised the potential in the Messerschmitt P.1101 and was the driving force behind getting the aircraft to the USA for further evaluation. In 1948 he proposed producing a limited run of fighters based on the P.1101.

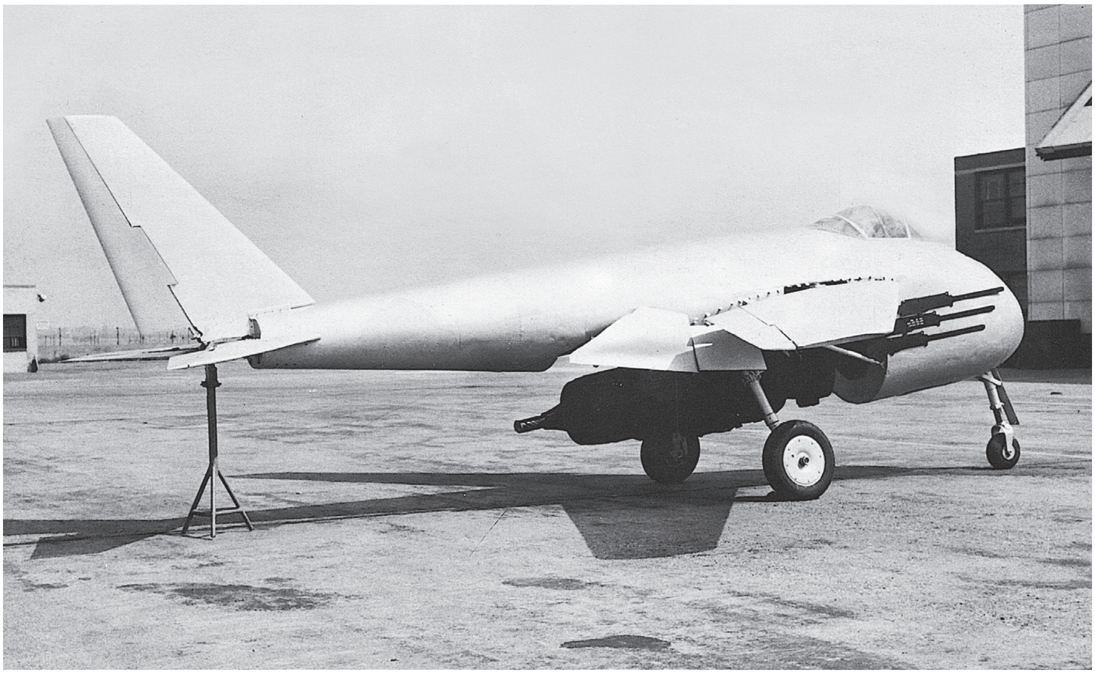
The shape of things to come? The P.1101 V1 under American skies at Buffalo during its assessment by the Bell Aircraft Corporation in the late 1940s. The Allison J35 engine lacks an intake duct at this point. The aircraft has a much improved appearance and carries silhouettes on its right nose to mark where it was intended to fit three .50cal machine guns (another three being installed on the left side of the aircraft).

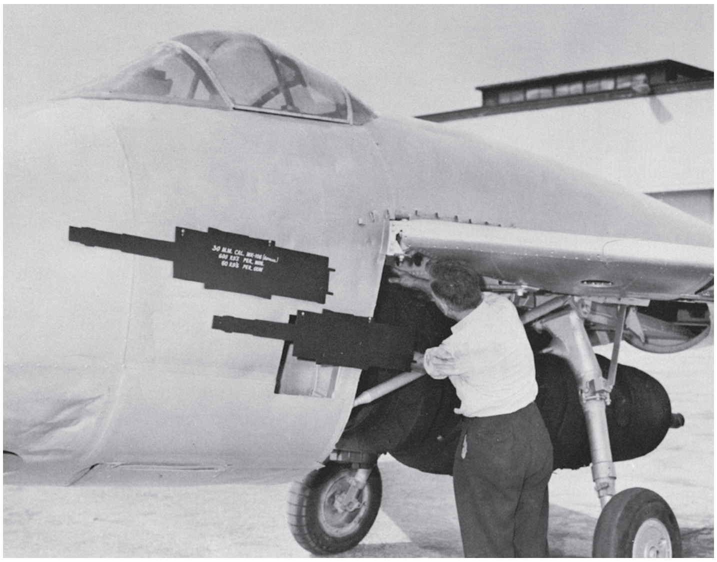
Transferred from the care of the USAF at Wright Field, the P.1101 V1 was moved to the Bell Aircraft Corporation at Buffalo, New York, and into the care of Robert J. Woods. Here, Bell personnel work on the restoration of the Messerschmitt's airframe, while in the background, engineers fabricate new components. It is possible that the man standing on the right wing is indeed Woods himself.



The restoration work undertaken by Bell is apparent in this photograph, although fresh damage appears to have been sustained by the nose panel. The aircraft has also been fitted with an Allison J35 axial-flow compressor turbojet which replaced the HeS 011 unit.





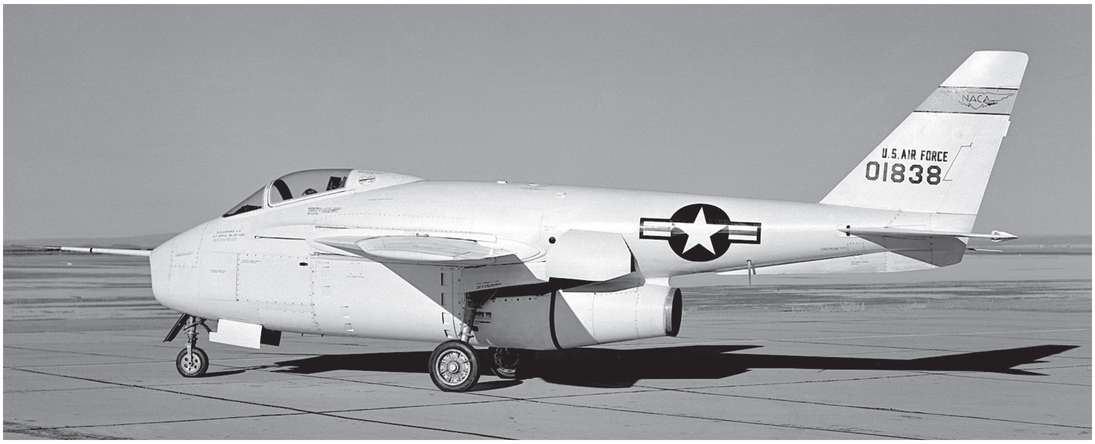


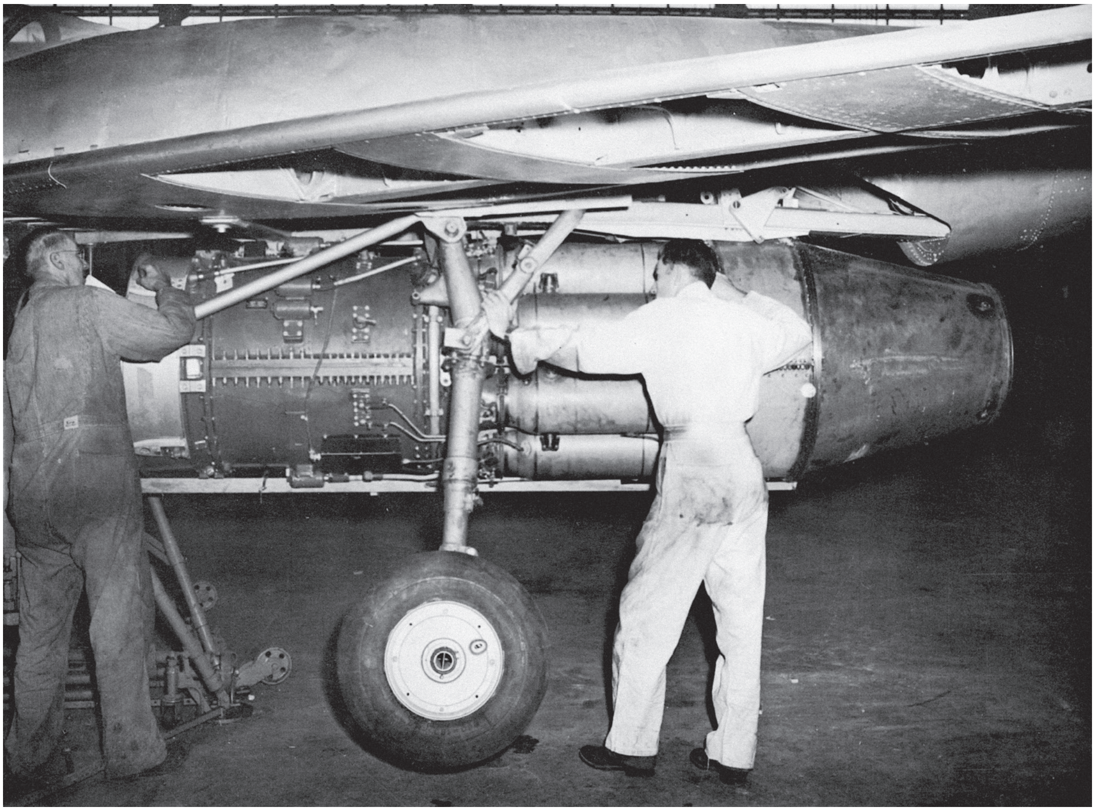
The former head of the Messerschmitt Projektbüro at Oberammergau, Dipl.-Ing. Woldemar Voigt, examines the J35 engine on the P.1101 V1. Voigt worked with Robert Woods on the restoration of the aircraft. The left side of the fuselage was marked with silhouettes to show where the original MK 108 cannon had been fitted. The wording on the upper silhouette reads '30 M.M. CAL. MK-108 (German). 600 RD'S PER MIN. 60 RD'S PER GUN'.

Voigt, erstwhile head of the Messerschmitt *Projektbüro*, who had been brought to America as part of Operation 'Paperclip' (the United States Office of Strategic Services programme in which more than 1,500 Germans, primarily scientists but also engineers, were given government employment in the USA), mainly because of his work on the P.1101. His research into variable swept-wing design would be invaluable to the American efforts.

In August 1948 Woods suggested producing an improved version of the aircraft with a moveable wing, and also arranged to fit three Browning M2 0.5-cal machine gun mock-ups externally on either side of the nose to indicate where the aircraft's armament was to be eventually installed (internally). With support from Bell, Woods further proposed building an initial run of 24 variable-geometry fighters based on the P.1101, but the idea was dismissed by the USAF on the basis that the airframe was too small to carry the armament proposed, and that there was insufficient fuel capacity for longer-range missions. At that point Wright Field handed the aircraft over to Bell, declaring it as

The pristine Bell X-5 01838 at Edwards AFB, in California, at the time it commenced tests by the High-Speed Flight Research Station in early 1952. The 'ancestry' of the P.1101 is clearly visible in the X-5's profile.



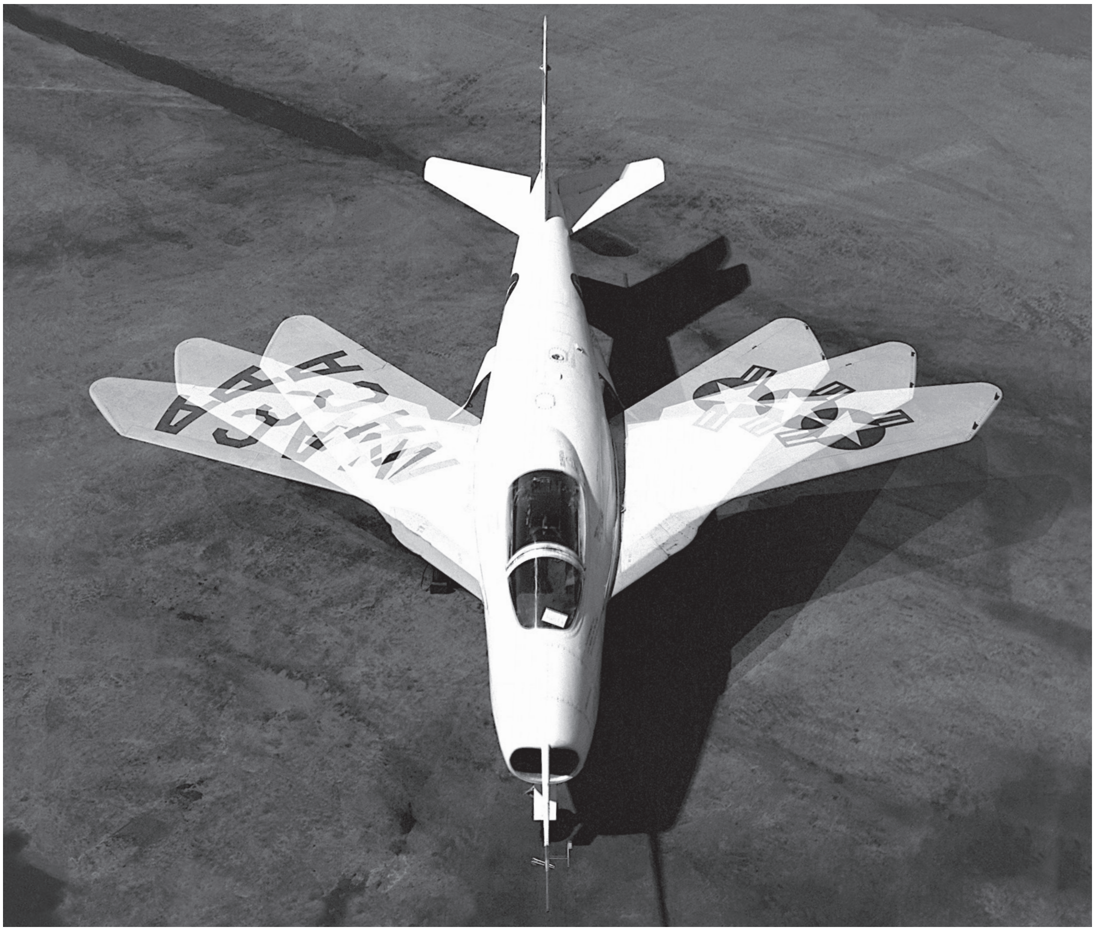


Bell Aircraft Corporation mechanics check the installation of the Allison J35 engine on the P.1101 V1 at Buffalo. Originally developed by the General Electric Corporation, the J35 was the USAF's first axial-flow compressor engine. In 1947 production of the engine was transferred to the Allison Division of General Motors. The J35 powered the X-5 variable-sweep research aircraft and several prototypes including the XB-43, XB-45, XB-46, XB-47, XB-48 and XB-49. During the 1950s it was used in the F-84B/C/D/E/G Thunderjet and the F-89 Scorpion. More than 14,000 such engines had been built by the time production ended in 1955.

surplus, but during its movement by road from Ohio to Buffalo it was badly damaged once again when it came off the transporter vehicle as a result of an accident.

At Buffalo, Woods and the Bell engineering team had hoped to adapt the P.1101 to accommodate other American engines, but they eventually concluded that the process would be complex and take up too much time. Thus, two things happened – firstly, the V1 airframe was apparently scrapped, and secondly, Bell devised plans for an entirely new variable-geometry fighter. On 4 February 1949 the USAF approved the plans and wind tunnel tests commenced at Langley under the project designation 'X-5'. This design planned for the wing sweep-back to be variable between 20 and 60 degrees within 20 seconds. This meant an operational aircraft could take off with its wings fully extended, reducing both its takeoff speed and the length of the runway needed, and then once in the air, the wings could be swept back, reducing drag and increasing the aircraft's speed. The fuselage design of the X-5 was modified to house a variety of American turbojets and changes were made to the tail surfaces; otherwise the new machine stayed largely faithful to Messerschmitt's design.

On 13 July Bell was awarded a contract to build two X-5 prototypes to be powered most probably by Allison J35-A-17s that provided 4,900lb (21.80kN) of thrust. However, the research laboratory at Wright Field put forward several modification proposals, and at one

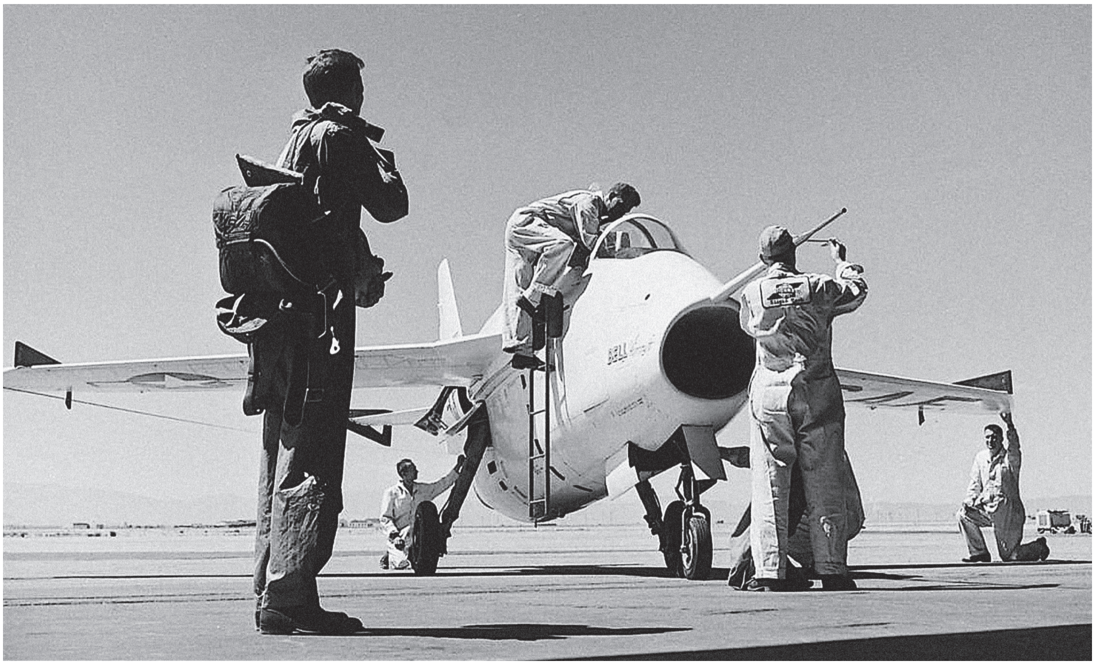


A multiple-exposure photograph from September 1952 showing the variable wing-sweep of the X-5, which could be adjusted in flight from a 20-degree angle to a 60-degree angle in a procedure that took about 20 seconds. The uppersurface view of the aircraft bore a considerable similarity to that of the P.1101.

stage even questioned the point of the whole project. Woods remained undeterred and pressed on with the construction of a full-size wooden mock-up, which was completed in the late autumn of 1949. The mock-up resulted in 76 requested modifications, after which work commenced on the prototypes.

In early 1951, the first X-5, s/n 50-1838, was rolled out and ground-tested. The aircraft was similar in shape to the P.1101, with a nose-mounted intake, a bubble canopy, an underslung engine and a boom-mounted tail. The wings could pivot in flight, but the mechanism used to swivel them was complex. As the wings were swept back, the centres of gravity and pressure changed. To compensate, the entire wing assembly moved forward on rails simultaneously inside the fuselage. Sweeping the wings from a 20-degree angle to the full 60-degree angle required that they also be moved about 27 inches forward from their starting position. This procedure took about 20 seconds. In the event of an electrical failure, the pilot could hand-crank the wings back into landing position.

On 9 June 1951, X-5 50-1838 was flown in a Fairchild C-119 Flying Boxcar to Edwards Air Force Base (AFB) in California, where, on the 20th of that month, Bell company test pilot Jean 'Skip' Ziegler made



Under a cloudless Californian sky, Bell company test pilot Jean 'Skip' Ziegler prepares to climb into X-5 01838 for a test-flight from Edwards AFB in 1951. Ziegler successfully evaluated the variable sweep wing in flight.

the world's first test-flight of an aircraft with a variable sweep wing. However, it would not be until the ninth flight, on 27 July, that Ziegler actually tested the wing movement. On 10 December he piloted the second X-5, s/n 50-1839, on its maiden flight.

By early January 1952, after a total of 27 Bell and USAF test-flights, the X-5 was handed over to NACA. Tests conducted by the latter organisation highlighted some problems. The High-Speed Flight Research Station pilot Albert Scott Crossfield recalled, 'The X-5 was not a comfortable airplane to fly. It had a low-slung engine, so there was a misalignment of the drag axis, and the principal axis, and the thrust axis, and all of that. So it could get into some interesting manoeuvres and motions, and that sort of thing – it was a terrible airplane in a spin. It took a long time to get that airplane out of a spin.'

Indeed, on 13 October 1953 Maj Raymond A. Popson, an experimental test pilot at Edwards AFB, was killed in X-5 50-1839 when it entered a spin from which he was unable to recover. Popson attempted to eject but died when the X-5 hit the ground. Another High-Speed Flight Research Station test pilot, Stanley P. Butchart, remembered the X-5's spin and braking characteristics: 'You just had to know that and stay away from it. The speed brakes on the X-5 were up front. When you opened the speed brakes, you got quite a nose down pitch. Well, now, it would be very unacceptable, but in a research airplane you put up with it because it's all you've got.'

The X-5 test programme continued until 1955. On 25 October of that year a new recruit to the High-Speed Flight Research Station by the name of Neil A. Armstrong made the final flight. X-5 50-1838 completed a total of 122 test-flights, but in March 1958 it was 'retired' to the USAF Museum.

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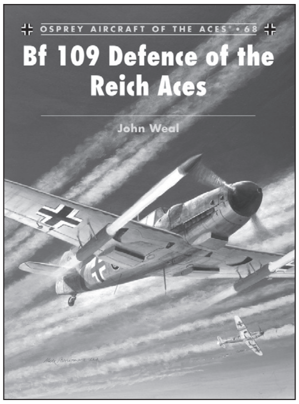
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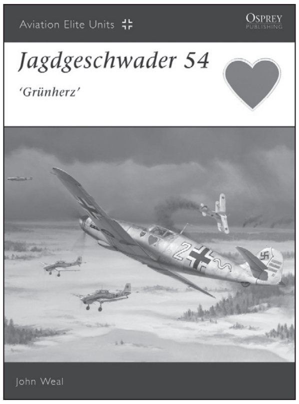
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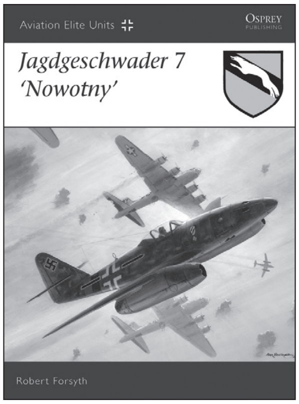
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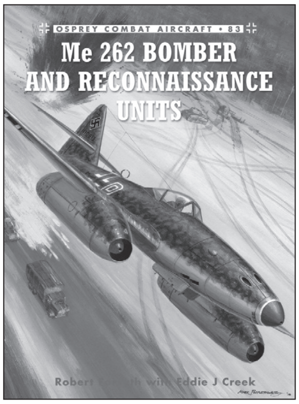
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